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Important Note

Every effort has been made to ensure the accuracy of the information given in this handbook, but the Department of Computer Science & Engineering of the University of Moratuwa is unable to accept responsibility for any errors or omissions. University courses are continuously reviewed and revised and there may well be some changes between the date of publication and the date the student embarks on the course. The University reserves the right to amend By-laws and Regulations governing courses of study as it sees fit. Students and other interested parties should seek clarifications from the relevant Semester Coordinators and the Head of the Department of Computer Science & Engineering about the changes to the programme and its modules/courses as close to the beginning of the academic Semester as possible. Admittance to the University is subject to the requirements that the student will comply with the Universitiy's registration and examination procedures and will duly observe the By-laws and Regulations of the University.

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Introduction to the Department of CSE

The Department of Computer Science & Engineering of the University of Moratuwa was established in 1985 and is a pioneer in ICT (Information and Communication Technology) education in Sri Lanka. The Department offers a BSc Engineering Honours Degree specialized in Computer Science and Engineering as its flagship academic course. The intake of this program has grown steadily from 16 students in the inaugural batch to 125 per batch currently with two study streams. The graduates of this degree programme are highly sought after by the industry as evidenced by the fact that typically more than 90% of students of a graduating batch get offers for employment before graduation and 100% of employment at graduation.

The Department also conducts three postgraduate courses that involve both taught courses and a research thesis, namely the MSc in Computer Science (MSc-CS), the MBA in Information Technology (MBA-IT) and MBA in e-Governance (MBA-eGov). The Department also conducts research based MSc and MPhil programmes. At present, the Academic Staff of the Department includes 2 Professors, 12 Senior Lecturers and 4 Lecturers supplemented by 10 Visiting Lecturers. Their research work involves many areas in computer science and computer engineering such as localization, e-Learning, big data, text mining, image processing, robotics, VLSI (Very Large Scale Integration), networking, knowledge representation, computer and network security, and cryptography. The Academic Support Staff of the Department consists of 2 Systems Engineers, 1 System Analyst, 1 Maintenance Engineer and 10 Instructors with 14 Non-academic Support Staff members.

The Department offers two study programs within the BSc Engineering Honours Degree specialized in Computer Science and Engineering as (1) Computer Science & Engineering (CSE) Stream with 100 undergraduates and (2) Integrated Computer Engineering (ICE) Stream with 25 undergraduates. While the long established CSE program provides the industry with its top-tier technical talent and expertise, the newly established ICE program is intended to build on the success achieved by the Department in meeting the industry need for top quality software engineers, systems engineers and network engineers and leverage that expertise to produce the industrial computer engineers needed by the country in its national development program. Such engineers are in high demand in the ICT sector of Sri Lanka as well as in the international job market.

Attributes of an Engineering Graduate

The Department of CSE has a carefully designed undergraduate study program that is in line with the best practices of other world renowned engineering universities. The learning environment of the Department complies with the requirements of both national and international accreditation organizations.

- The academic staff of the Department consists of full-time faculty with experience and on-going involvement with the industry as well as visiting faculty from the industry.
- The Department facilitates the industrial training of students at organizations that utilize the latest in technology and management techniques.
- The Department facilitates industry collaboration for the final year R&D project of the students ensuring a meaningful industry focus for the project outcomes.
- The undergraduate program has a strong component in the study and practice of professional ethics and institutional codes of practice.
- The Department has an active event calendar facilitating interaction with the industry and community that include guest lectures, industry visits, competition organizing, outreach activities and social events.
- The laboratory facilities of the Department are kept updated to provide the students with the latest technology.
- The curriculum and syllabi of the study program is kept updated to reflect the latest technological developments and industry innovations.

The study program of the Department has an in-depth coverage of the theoretical core of Computer Science and Engineering including computer systems, software engineering, operating systems, computer architecture, computer networks, data structures and algorithms, theory of electricity, and principles of electronics. These study areas are extended with modern applications and practices including object oriented programming, databases, data communication, microprocessor based systems, and management information systems.

The objective of this study program is to ensure that graduands from the Department have the qualities and abilities of a capable professional engineer. The desired generic attributes of an engineering graduate encompass following areas:

- **Engineering Knowledge:** Apply knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems
- **Problem Analysis:** Identify, formulate, research literature and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences.
- **Design/ development of solutions:** Design solutions for complex engineering problems and design systems, components or processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal, and environmental considerations.
- **Investigation:** Conduct investigations of complex problems using research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of information to provide valid conclusions.
- **Modern Tool Usage:** Create, select and apply appropriate techniques, resources, and modern engineering and IT tools, including prediction and modelling, to complex engineering activities, with an understanding of the limitations.
- **The Engineer and Society:** Apply reasoning informed by contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to professional engineering practice.
- **Environment and Sustainability:** Understand the impact of professional engineering solutions in societal and environmental contexts and demonstrate knowledge of and need for sustainable development.
- **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of engineering practice.
- **Individual and Team work:** Function effectively as an individual, and as a member or leader in diverse teams and in multi-disciplinary settings.
- **Communication:** Communicate effectively on complex engineering activities with the engineering community.
- **Project Management and Finance**: Acquire skills, such as being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
- **Lifelong learning:** Demonstrate knowledge and understanding of engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

Reference: ENGINEERING PROGRAMME ACCREDITATION MANUAL, INSTITUTION OF ENGINEERS, SRI LANKA. June 2011

Studying at Department of CSE

Computer Science and Engineering is at the heart of almost everything in today's world. Be it in communications, transport, financial services, publishing, medicine, agriculture or numerous other fields, IT solutions designed by CS&E professionals have sped up and simplified the work of many other professions, allowing us to live the way we do today.

The Department of Computer Science and Engineering (CSE) at the University of Moratuwa is the only state-run institution in Sri Lanka to offer Degree programmes in Computer Science and Engineering, at the undergraduate or postgraduate levels. However, this is but one reason to study at CSE.

Quality of Teaching

Our academic staff, many of whom are alumni of the department is a dedicated, passionate group who seeks to impart both the knowledge and wisdom they have gained from many years of experience in both industry and academia to the students. In addition to their teaching and research responsibilities, many staff members are also engaged as consultants for projects involving CSE solutions both in Sri Lanka and abroad, enhancing their ability to provide current and relevant teaching to their students.

Industry Relevance

All curricula at the Department of Computer Science and Engineering are designed in accordance with current industry best practice and in consultation with CSE professionals both here and abroad. This ensures that graduates possess the skills and knowledge to transit seamlessly into the workforce and function effectively both now and in the future.

Academic and Laboratory Facilities

The department possesses a number of computer labs that meet the academic purposes of all students and staff, with modern machines and broadband access via the University server to each computer. In addition, wireless access to the Internet is available throughout the department.

Research Opportunities

The Department places a strong emphasis on research, with ongoing projects in the areas of computational intelligence, e-learning, computer security and computation in local languages. Students have the ability to participate in these

projects and have access to the latest developer tools from organizations such as Microsoft to assist them in their endeavours.

Avenues for Further Study

The Department offers a number of postgraduate qualifications that enable students to further enhance their employment prospects or their academic interests. These include a Postgraduate Diploma (PG Dip) in Computer Science, MSc programmes in Research and Computer Science as well as MBA programmes in IT and e-Governance. In addition, studying at the department will provide students wishing to carry out further studies abroad the contacts and knowledge base necessary for success in such ventures.

Awards and Scholarships

Gold Medal - IBM Sri Lanka

Awarded to the Computer Science and Engineering graduate who obtained the highest overall GPA of 3.8 or above at the B.Sc. Engineering degree examinations. This award is given at the University General Convocation.

Manamperi Award - Sri Lanka Association for the Advancement of Science

The best undergraduate research engineering project carried out at a faculty of engineering in a Sri Lankan University is awarded annually with this award. The students who have submitted their undergraduate engineering project to a Sri Lankan University within the academic year in consideration are eligible to apply for this award. A duly completed application along with a project report not exceeding 1500 words should be submitted to the SLAAS by the students themselves, in order to be considered for this award.

Migara Ranatunga Trust Award - Institution of Engineers Sri Lanka

This is awarded by IESL to the best achievers of the semester 6 industrial training module at the Annual Sessions of IESL. The university training division forwards the results of the evaluations at the end of the training module to the IESL. Few undergraduates would be fortunate to be recognized as high achievers in the industrial training module of the engineering undergraduate program by being awarded with this.

Vidya Jyothi Professor Dayantha S Wijesekera Award

This is awarded to the most outstanding student of the year at the University of Moratuwa − a student who has proven himself/herself as a versatile graduate with a GPA exceeding 3.7 (First Class Honours) and who has also contributed to the university and the community with recognition as a leader.

Contact Information

Department Office:

2nd Floor, Sumanadasa Building

Faculty of Engineering

University of Moratuwa

URL: http://www.cse.mrt.ac.lk/

Phone: +94 112 650 301 extension 3100

Phone: +94 112 640 380, + 94 112 650 475

Fax: +94 112 650 912, +94 112 650 622

Head of the Department:

Eng. Dr. Chathura De Silva

PhD (NUS-Singapore), MEng (NTU-Singapore), BSc Eng (Hons) (Moratuwa), MIE (SL), CEng

Ext. No: 3101

E-mail: chathura@cse.mrt.ac.lk

Staff Details

Academic Staff

Professors

Prof. Gihan Dias
PhD (UCDavis), MS(UCSB), BSc Eng (Moratuwa),
MIE(SL), CEng
Ext. No: 3112
E-mail: gihan@uom.lk

Eng. Associate Prof. Sanath Jayasena
PhD (UIUC), MSc (UIUC), BSc Eng(Hons) (Moratuwa),
MIE(SL), CEng
Ext. No: 3119
E-mail: sanath@cse.mrt.ac.lk

Senior Lecturers

Dr. Dilum Bandara

PhD (CSU), MS (CSU), BSc Eng(Hons) (Moratuwa)

Ext. No: 6022

E-mail: dilumb@cse.mrt.ac.lk

Eng. Dr. Chathura De Silva

PhD (NUS-Singapore), MEng (NTU-Singapore),

BSc Eng(Hons) (Moratuwa), MIE (SL), CEng

Ext. No: 3101

E-mail: chathura@cse.mrt.ac.lk

Dr. Rapti De Silva

PhD (Syracuse), MSc (Virginia),

BA Hons Summa Cum Laude (Sweet Briar)

Ext. No: 6024

E-mail: rapti@cse.mrt.ac.lk

Eng. Dr. Shantha Fernando

PhD (TU Delft), MPhil (Moratuwa), BSc Eng(Hons) (Moratuwa), MCS(SL), MIE(SL), MIET(UK), CEng

Ext. No: 3113

E-mail: shantha@cse.mrt.ac.lk

Eng. Lt. Col. Dr. Chandana Gamage
PhD (Monash), MEng (AIT), BSc Eng(Hons) (Moratuwa),
MIE (SL), CEng
E-mail: chandag@cse.mrt.ac.lk

Dr. Dulani Meedeniya
PhD (St Andrews), MSc (Moratuwa), BSc (Hons) (Peradeniya),
FHEA (UK), CEng (UK)
Ext. No: 3111
E-mail: dulanim@cse.mrt.ac.lk

Ms. Vishaka Nanayakkara
Tech Licentiate (Chalmers), BSc Eng(Hons) (Moratuwa)
E-mail: vishaka@cse.mrt.ac.lk

Dr. Indika Perera
PhD (St Andrews), MBS (Colombo), MSc (Moratuwa),
BSc Eng(Hons) (Moratuwa), PGDBM (Colombo),
FHEA (UK), CEng (UK), MIE (SL)
E-mail: indika@cse.mrt.ac.lk

Dr. Shehan Perera
PhD (NDSU), MSc (NDSU), BSc (Hons) (Colombo)
Ext. No: 3116
E-mail: shehan@cse.mrt.ac.lk

Dr. Malaka Walpola
PhD (FIU),BSc Eng(Hons) (Moratuwa)
Ext. No: 6051
E-mail: malaka@cse.mrt.ac.lk

Dr. Surangika Ranatunga
PhD (Otago), BSc Eng(Hons) (Moratuwa).
E-mail: surangika@cse.mrt.ac.lk

Mr. Nalin Karunasinghe
MEng (NUS), BSc Eng(Hons) (Moratuwa)
nalin@cse.mrt.ac.lk
nalin@ieee.org

Lecturers

Eng. Ms. Sulochana Sooriyarachchi
MSc (Moratuwa), BSc Eng (Hons) (Peradeniya), AMIE(SL)
Ext. No: 3118
E-mail: sulochanas@cse.mrt.ac.lk

Dr. Charith Chitraranjan
PhD, MSc (NDSU), BSc Eng(Hons) (Moratuwa)
E-mail: charithc@cse.mrt.ac.lk

Ms. Sandareka Fernando
MSc (NTU), BSc Eng(Hons) (Moratuwa)
Ext. No: 3118
Email: sandarekaf@cse.mrt.ac.lk

Ms. Sandareka Wickramanayake
BSc Eng (Hons) (Moratuwa)
Ext. No: 3118
Email: sandarekaw@cse.mrt.ac.lk

Ms. Sadari Jayawardena
BSc Eng(Hons) (Moratuwa)
Ext. No: 3120
Email: sadari@cse.mrt.ac.lk

Junior Consultants

Ms. Sachini Herath
BSc Eng(Hons) (Moratuwa)
Ext. No: 3120
Email: sachini.h@cse.mrt.ac.lk

Mr. Pranavan Theivendiram
BSc Eng(Hons) (Moratuwa)
Email: pranavan.11@cse.mrt.ac.lk

Visiting Lecturers

Mr. Samisa Abeysinghe
BSc Eng. (Hons) (Moratuwa)
E-mail : samisa@wso2.com

Eng. Chamara Disanayake
MSc (Moratuwa), BSc Eng.(Hons)(Moratuwa)
E-mail : chamara@nic.lk

Mr. Sanjaya Karunasena
BSc Eng (Hons)(Moratuwa)

Dr. Upali Khomban

PhD (NUS), BSc. Eng Hons (UOM)

Dr. Raveendra Koggalage

PhD (Melb),MEng (NTU),MSc (NUS), BSc. Eng Hons (UOM)

E-mail: koggalage@ent.mrt.ac.lk

Eng. Dileepa Lathsara

MSc in Computer & Network Security, BSc Eng. (Hons) (Moratuwa)

E-mail: lathsara@techcert.lk

Dr. Prathiba Mahanamahewa

PhD (Queensland), LLB Hons (UoC), LLB Hons (Melbourne)

E-mail: prathiba@law.cmb.ac.lk

Dr.Srinath Perera

PhD (Indiana), MSc (Indiana), BSc. Eng. (Hons) (Moratuwa)

E-mail: srinath@wso2.com

Lt.Col Athula Samarasinghe

MSc in Computer & Network Security (Moratuwa), BIT (UCSC), C|EH

Eng. Chandana Weerasinghe

BSc Eng. (Hons) (Moratuwa), C. Eng

Dr. Sanjiva Weerawarana

PhD (Computer Science) (Purdue), MS (Kent State University), BS (Applied Mathematics/Computer Science) (Kent State University)

E-mail: sanjiva@opensource.lk

Academic Staff (on study leave)

Mr. Nisansa de Silva
BSc Eng (Hons) (Moratuwa), AMIE(SL)
Ext. No: 3120
E-mail: NisansaDdS@cse.mrt.ac.lk

Mr. Adeesha Wijayasiri
BSc Eng (Hons) (Moratuwa), AMIE(SL)
Ext. No: 3606
E-mail : adeeshaw@cse.mrt.ac.lk

Ms. Sachini Weerawardhana
MSc (Moratuwa), BSc (Hons)(UCSC)
E-mail: sachini.sw@cse.mrt.ac.lk

Ms. Pivithuru Wijegunawardana
BSc Eng (Hons) (Moratuwa)
Ext. No: 3120
E-mail : pivithuruw@cse.mrt.ac.lk

Mr. Gayashan Amarasinghe
BSc Eng(Hons) (Moratuwa)
Email: gayashan@cse.mrt.ac.lk

Ms. Madhushi Bandara
BSc Eng(Hons) (Moratuwa)
Email: madhushi@cse.mrt.ac.lk

Ms. Akila Pemasiri
BSc Eng(Hons) (Moratuwa)
Email: akila@cse.mrt.ac.lk

Academic Support Staff

Instructors

Mr. Gayan Ranasinghe
BSc Special (Hons) IT (SLIIT)
Ext. No: 3503
E-mail: gayanr@uom.lk

Ms. Hiroshi De Silva
BSc (IT) (Curtin)
Ext. No: 3503
E-mail: hiroshides@cse.mrt.ac.lk

Ms. Shashieka Fernando
B. Eng. (CS&T), MSc. (South China University of Technology)
Ext. No: 3503
E-mail: shashiekaf@cse.mrt.ac.lk

Ms. Ushani Jayatilaka
BSc Special (Hons) IT (SLIIT)
Ext. No: 3503
E-mail: ushanij@cse.mrt.ac.lk

Ms. Uresha Gayanthi
BSc Special (Hons) IT (SLIIT)
Ext. No: 3503
E-mail: ugayanthi@cse.mrt.ac.lk

Ms. Wimasha Layanthi
BSc Special (Hons) IT (SLIIT)
Ext. No: 3503
E-mail: wlayanthi@cse.mrt.ac.lk

Mr. Sulakshan Samaradiwakera
BSc (General) (Delhi)
Ext. No: 3503
E-mail: sulakshan@cse.mrt.ac.lk

Mr. Mohomad Rilfi
BSc Special (Hons) South Eastern University
Ext. No: 3503
E-mail: rilfi@cse.mrt.ac.lk

Mr. Ponnampalam Pirapuraj
Bsc(Hons) Special (Computer Science)(South Eastern University)
Email: pirapu@cse.mrt.ac.lk

Mr. Darshana Muththettugoda
BSc (Software Engineering)
Ext. No: 3503

Mr. Manohararajan Saranraj
BSc (Computer Science)
Ext. No: 3503
E-mail: saranr@cse.mrt.ac.lk

Systems Engineers

Mr. Sujith Fernando
Systems Engineer
BSc Special (Hons) in IT (SLIIT)
Ext. No: 3605
E-mail: sujithf@cse.mrt.ac.lk

Mr. Sanjaya Sooriyarachchi
Engineer (Computer Maintenance)
BSc in Physical Science (Electronics)(Kelaniya)
Ext. No: 3173
E-mail: sanjayas@uom.lk

Mr. Sanjeewa Darshana
BSc (Physical Science) (Peradeniya)
Ext. No: 3605
E-mail: sanjeewa.darshana@cse.mrt.ac.lk

Mr. Harsha K. Thewala Arachchi
BSc (Physical Science) (Electronics) (Kelaniya)
Ext. No: 3605
E-mail: harshak@cse.mrt.ac.lk

Mr. Pasan Premarathne
Systems Engineer
BSc (Information Systems)
Ext No: 3605
E-mail: pasann@cse.mrt.ac.lk

Mr. Thusitha Bandara
Systems Engineer
BSc (Computer Science)
Ext No: 3605
E-mail: thusithab@cse.mrt.ac.lk

Technical Officers

Mr. Wasantha Edirisooriya
Technical Officer
Ext. No: 3164
E-mail: wasanthae@cse.mrt.ac.lk

Mr. H.K. Jinadasa
Technical Officer
Ext. No: 3503
E-mail: hkjinadasa@cse.mrt.ac.lk

Mr. J.C. Rajapaksa
Technical Officer
Ext. No: 3151
E-mail: jcraja@cse.mrt.ac.lk

Ms. E.M. Hettiarachchi
Technical Officer
Email: emeraldh@cse.mrt.ac.lk

Mr. D.D. Ramanayake
Trainee Technical Officer
Ext. No: 3503
E-mail: dilharar@cse.mrt.ac.lk

Administration Office

Ms. Lakshika Jayadewa
Clerk
Ext. No: 3100
E-mail: lakshikaj@cse.mrt.ac.lk

Ms. Kalindi Hewawasam
Computer Application Assistant
Ext. No: 3102
E-mail: kalindih@cse.mrt.ac.lk

Ms. Nisansala Samarasuriya
Computer Applications Assistant (On Contract)
Ext. No: 3102
Email: nisansalas@cse.mrt.ac.lk

Laboratory Attendants

Mr. A.H.G. Indika
Laboratory Attendant
Ext. No: 3153
E-mail: indikag@cse.mrt.ac.lk

Mr. Pathum Rangana
Laboratory Attendant
Ext. No: 3165
E-mail: pathumr@cse.mrt.ac.lk

Mr. T.H. Rasanga Vinodh
Laboratory Attendant
Ext. No: 3151
E-mail: rasanga@cse.mrt.ac.lk

Mr. Pradeep Priyankara
Laboratory Attendant
Ext. No: 3102

Mr. Dhanushka Sanjeewa
Laboratory Attendant
Ext. No: 3165

Mr. Bimsara Kumarnayake
Laboratory Attendant
Ext. No: 3165

Post Graduate Assistant

Mr. W.A.S Nishan
MSc Course Assistant
Ext. No: 3100
E-mail: nishans@cse.mrt.ac.lk

Mr. Dinesh Bandara
MBA Course Assistant
Ext. No: 3102
E-mail: dineshb@cse.mrt.ac.lk

CS & ES Staff

Mr. Kamal Rodrigo
Computing Support Officer
Ext. No: 3102
E-mail: kamalr@cse.mrt.ac.lk

B.Sc. Engineering Honours Degree Programme

Computer Science & Engineering Specialization

Graduate Profile

Course Philosophy

To produce graduate engineers who can, with creativity and innovation, craft solutions through a systematic design, development and integration of computer hardware engineering, software engineering, network engineering and knowledge which embeds to the material world to change systems and processes for the benefit of humanity.

Graduate Profile

The Knowledge, Skills, Attributes and Qualities of an Engineer in the specialization of Computer Science and Engineering

1. Ability to analyze complex problems and design, develop and evaluate solutions using specialist knowledge from the domain of computer engineering that satisfy performance, efficiency, safety, reliability, quality, cost and environmental constraints. [Knowledge & Understanding]

2. Ability to apply mathematical, scientific and technological methodologies and tools to solve problems incorporating creative and innovative thinking in the context of design, development and integration in the domain of computer engineering. [Intellectual Abilities]

3. Ability to conceptualize solutions in distributed environments through appropriate software and data distribution and introduction of new technologies through a process of partitioning in the domain of computer engineering. [Intellectual Abilities]

4. Ability to conceptualize solutions in constrained environments through appropriate hardware-software partitioning and introduction of new technologies through a process of integration in the domain of computer engineering. [Intellectual Abilities]

5. Ability to solve complex cross-domain problems through application of integrative skills, theoretical knowledge and product engineering techniques. [Practical Skills]

6. Ability to demonstrate cross-domain design capabilities by incorporating heterogeneous systems including computer hardware, software, automated systems and embedded systems. [Practical Skills]

7. Ability to communicate effectively in written and oral forms to both

technical and non-technical audiences. [General Transferable Skills]

8. Ability to work cooperatively and effectively in multi-disciplinary teams. [General Transferable Skills]

9. Be self-motivated, enthusiastic and to undertake lifelong learning for continuing professional development. [Qualities]

10. Be an individual with an independence of mind, with intellectual integrity possessing professional and ethical behavior. [Qualities]

Learner Support Environment

The learning environment and the learner support systems in the Department of CSE have been developed over time to meet changing requirements of the undergraduates, the industry and also technological developments. The key points of this approach are:

- Promoting student interaction at lectures
- Using problem based learning approach when suitable
- Emphasizing soft skills of the students
- Using e-Learning systems and other on-line teaching and learning technologies
- Adopting global standards in engineering education such as outcome based education (OBE)
- Promoting self-discovery and experimentation
- Incorporating humanities to the study of engineering
- Improving teaching skills through student reviews and peer reviews

This blended approach has already produced graduates who are equipped with not only the subject knowledge but also the soft skills necessary to succeed at workplace and is evidenced by the employment offers received by new graduates and what they have achieved within a few years of graduation. This proven, successful approach will continued to be used and further improved.

Another important aspect of programme delivery in the Department of CSE is the close interaction with industry stakeholders for continued curriculum and syllabus improvement, improved experience at industrial training, and course delivery support through the use of domain experts from the industry.

Laboratories in the Department of CSE

Level 1 Computer Lab

Practical classes for all the first year students take place in this lab. Practical classes are held in groups of approximately 70 and the students are encouraged to use the computer facilities whenever the lab is free.

Level 2 Computer Lab

Level 2 Computer Lab, used by students in semesters 2 and 3, is configured to support all computer science and engineering practical conducted for those students in the Department. The lab is equipped with the latest versions of required software both in the Windows and Linux environments.

Level 3 Advanced Computing Lab

Level 3 Advanced Computing Lab, used by students in semesters 4 and 5, is configured to support all computer science and engineering practical conducted for those students in the Department. This lab, which is for the exclusive use of semester 4 and 5 students, allow them to use the lab for their software engineering projects where they are allowed to install and use any software required for their individual projects as well as to master different software tool kits so that they can be well prepared for their industrial training.

Level 4 Final Year Project Lab

Final Year Project Lab is mainly used for the undergraduate research and development projects of the students of the Department of CSE and each project team is allocated a separate space in the lab for their use. This lab is a Wi-Fi hotspot and allows the CSE final year students to bring their laptops and work on their final year projects or do other work. As every CSE student who does not have a laptop is provided with a laptop by the department, the lab does not contain any fixed computers. However, based specific on project requirements, both PCs and virtual servers are allocated to project teams.

Embedded Systems Lab

Embedded Systems Lab is primarily used for undergraduate teaching for modules such as Micro-controller Applications, Embedded Systems Design and Advance Digital Design. Additionally the resources available at the laboratory are also used for undergraduate research and development projects and for postgraduate research work. Resources available at the laboratory include development boards compatible with Arduino platform, microchip ChipKit platform and Raspberry PI boards. For embedded systems development and

related work several FPGA based development boards including Xilinx and Altera evaluation boards and development platforms are also available. The laboratory maintains a stock of prototyping boards and interfacing modules such as LCD modules, temperature sensors, encoder modules and related types of transducers for use in the undergraduate projects and laboratory classes. The laboratory implement a project based and "use at any time" policy for students which allows them to borrow equipment and components from the laboratory and carryout the necessary work at their own time subjected to the general operating policies of the laboratory.

Network Engineering Lab

Network Engineering Lab is used for conducting computer networking practical sessions for students of the Department of CSE. The lab is equipped with state of the art networking gear including CISCO routers and advanced gigabit switches, fiber optic equipment, media converters, KVMs etc. The areas of engineering practice covered using the above facilities are networking basics, routing, switching, VLAN, VPN, DNS and Web servers.

Video Production Lab & Studio

Video Production Studio Laboratory is a fully equipped studio production facility consist a sound-proof studio environment and a control room. The studio has full digital capabilities ranging from digital and computer generated virtual background setups to fully digital mixing and recording. The laboratory also has a complete mobile video production setup inclusive of video mixers and digital recording devices included in a single package. The facility is capable of carrying out live productions using up to 8 online cameras covering a coverage radius of almost 200m. The facility is primarily used to provide the equipment and technical support for laboratory work in undergraduate and post graduate modules related to image processing, computer vision and graphics. It also provides support for research and development through undergraduate and postgraduate student projects. The laboratory is responsible for conducting the non-GPA module on video production for the undergraduate students. The video production studio laboratory also hosts the Centre for Instructional Technology (CIT) of the university. Through CIT, the laboratory provides multimedia technical support and video coverage for all major events at the university inclusive of the graduation ceremonies and inauguration ceremonies for new intakes. The CIT is also responsible for production of staff and student identity cards.

High Performance Computing Lab

High Performance Computing (HPC) lab of the Department of CSE facilitates undergraduate and graduate teaching as well as research on systems, middleware, and algorithms addressing computational and data-intensive problems arising in scientific, business, and social domains. HPC lab has a private cloud computing facility, many computational nodes, and 50+ NVidia GPUs that are used by many students, faculty, and scientists within and outside the University Teaching, project, and research purposes. State-of-the-art open source software and middleware are used to provide the services of the HPC lab. Presently, the research teams are engaged in research on many/multi-cores, distributed systems, and cloud, grid, and peer-to-peer computing, as well as the interdisciplinary applications of those technologies. More details of the HPC lab are available at http://cse.mrt.ac.lk/hpc/.

Software Engineering Lab

The Software Engineering lab is equipped with the software necessary for Software Systems Design, Software Project Management, Software Architecture Evaluation and Quality Assuring. The Lab is used for the course modules in the Software Engineering stream at Undergraduate and Postgraduate levels as well as Research works.

CodeGen Innovation Lab

CodeGen Innovation Lab is dedicated for supporting students for innovative product design, product development and product commercialization. The lab is equipped as a modern entrepreneur incubator facility with computers and large displays helping students engage in the activities of entire product lifecycle in an enterprise like research and development environment. The lab is furnished with ergonomically supporting furniture for long duration development engagements giving a comfortable space while the access controlled entry mechanism enables 24x7 accesses to the authorized students and researchers. Several student groups have been actively utilizing the lab and its resources to develop their entrepreneurial skills through their product development.

Microsoft Lab

Microsoft Lab of the Department of CSE is equipped with 30 desktop computers and servers. These computers have the licensed commercial software such as MS Windows XP, MS Windows 2003 server, MS Windows 7, MS Windows 2008 server, Microsoft office, SQL server and MS Visual Studio Development Environment. The lab has gained access to the complete suite of Microsoft developer tools, operating systems, server software, documentation and technical references offered by Microsoft, as the department is a member of the MSDN Academic Alliance. Currently the lab maintains servers for the Level 1, Level 2 and Advanced Computer laboratories. Student projects and particular

student needs for MS development activities are facilitated by this lab and its resources.

Enterprise Systems Lab

Enterprise Systems Lab of Department of CSE is equipped with set of server machines which are used for the purpose of learning and configuration server systems. The lab provides facilities for undergraduates to acquire hands on experience in managing and implementing server systems including configurations of storage area networks and RAID systems. The lab also has several machines used by the undergraduates to conduct their Internet based research projects and they are configured with dedicated public IP addresses and uninterrupted power supplies with the aim of enabling extensive data mining purposes.

Data Science and Analytics Lab

Data Science and Analytics Lab or the BigData Lab of the Department of CSE facilitates undergraduate and graduate teaching as well as research in the science and engineering of big data storage and predictive analytics. The lab is equipped with a collection of quad core machines with 16GB of memory each in a resource pool that is equipped to allocate remotely accessible virtual boxes based on the requirements for each project. The lab has a very productive collaborative link with the Business Analytics Lab of Deakin University in Australia, with several active projects in the area of business analytics and incremental learning.

EWIS R&D Centre

EWIS Research and Development Centre of E-W Information Systems Ltd., the local Original Device Manufacturer (ODM), facilitates a partnership for knowledge sharing, the exchange of data, experience and technical equipment to the University students. Together with the University, EWIS will program and customize computer devices to suit the local educational environment and curriculum and its ecosystem. Over the years, the company has enriched the lives of thousands of teachers and students from primary through University levels with software and hardware. Also this is enables students from the University to get the chance to visit the EWIS Original Device Manufacturing plant in Sooriyawewa, to ascertain vital data on the improvement of its devices etc., and gain hands-on experiences.

Staff Allocation for Laboratories

Computer Laboratory	Lecturer in-charge	Technical Officer	Lab Attendant
Level 1 Computer Lab (S1)	Prof Sanath Jayasena	Mr DD Ramanayaka	Mr Pathum Rangana
Level 2 Computer Lab (S2 & S3)	Dr Shehan Perara	Mr JC Rajapakse	Mr Rasanga Vinodh
Level 3 Advanced Computing Lab (S4 & S5)	Dr Shehan Perara	Mr HK Jinadasa	Mr AHG Indika
Level 4 Final Year Project Lab (S7 & S8)	Dr Malaka Walpola	Mr Wasantha Edirisuriya	Mr AHG Indika

Engineering Laboratory	Lecturer in-charge	Academic Support Staff Member	Lab Attendant
Embedded Systems Lab	Dr Chathura De Silva	Mr Sanjaya Sooriyaarachchi	Mr Bimsara Kumarnayake
Network Engineering Lab	Dr Shantha Fernando	Mr Sujith Fernando	Mr Dhanushka Sanjeewa
Video Production Lab & Studio	Dr Chathura De Silva	Mr Sanjeewa Dharshana	Mr Bimsara Kumarnayake
High Performance Computing Lab	Dr Dilum Bandara	Mr Sujith Fernando	Temporarily located in Microsoft Lab
Software Engineering Lab	Dr Indika Perera	Mr Sujith Fernando	Co-located in Computer Labs
CodeGen Innovation Lab	Dr Indika Perera	Mr Sujith Fernando	Mr Rasanga Vinodh
Microsoft Lab	Dr Dulani Meedeniya	Mr DD Ramanayaka	Mr Dhanushka Sanjeewa
Enterprise Systems Lab	Dr. Indika Perera	Mr Sujith Fernando	Mr Rasanga Vinodh
BigData Lab	Dr Shehan Perera	Mr Sujith Fernando	Temporarily located in Enterprise Sys Lab
Robotics Lab	Dr Chathura De Silva	Mr Sanjaya Sooriyaarachchi	Temporarily located in Embedded Sys Lab
Data Communications Lab	Dr Shantha Fernando	Mr Sujith Fernando	Mr Dhanushka Sanjeewa
EWIS R&D Center	Dr Chathura De Silva	Mr Sanjeewa Dharshana	Mr. Pradeep Priyankara

CSE Stream

Module Code	Module Name	Category	Lectures hrs/week	Lab/ Assignm hrs/weeks	Credits		Norm		Evaluation (%)	
					GPA	NGPA	GPA	NGPA	CA	WE
Semester 1										
MA1013	Mathematics	C	3.0	1/1	3.0				20	80
CS1032	Programming Fundamentals	C	2.0	3/1	3.0				20	80
ME1032	Mechanics	C	2.0	3/4	2.0				20	80
MT1022	Properties of Materials	C	2.0	3/4	2.0				20	80
CE1022	Fluid Mechanics	C	2.0	3/4	2.0				20	80
EE1012	Electrical Engineering	C	2.0	3/4	2.0				20	80
EL1012	Language Skill Enhancement I	C	-	3/1	1.0		15.0		20	80
MN1012	Engineering in Context	C	1.0	-		1.0		1.0	30	70
				Total for Semester 1			15.0	1.0		
Semester 2										
CS2012	Principles of Object Oriented Programming	C	2.0	3/1	3.0				40	60
CS2022	Data Structures and Algorithms	C	2.0	3/2	2.5				40	60
CS2052	Computer Architecture	C	2.0	3/1	3.0				40	60
EN1012	Electronic Devices and Circuits	C	2.0	-	2.0				40	60
MA1032	Numerical Methods for Computer Science	C	3.0	-	3.0				30	70
EE2093	Theory of Electricity	C	2.0	-	2.0		19.5		30	70
CS2952	Communication Skills	C	0.5	3/1	1.5				80	20
ME1802	Introduction to Manufacturing Engineering	C	2.0	3/2	2.5				30	70
CS1962	Engineering Skill Development	C	0.5	3/1		1.5		1.5	100	-
				Total for Semester 2			19.5	1.5		
Semester 3										
CS2032	Principles of Computer Communication	C	2.0	3/1	3.0				40	60
CS2042	Operating Systems	C	2.0	3/2	2.5				40	60
CS2062	Object Oriented Software Development	C	2.0	3/1	3.0				40	60
EN2022	Digital Electronics	C	2.0	3/2	2.5				30	70
CE1822	Aspects of Civil Engineering	C	2.0	-	2.0				30	70
ME1822	Basic Engineering Thermodynamics	C	1.5	3/2	2.0				30	70

Module Code	Module Name	Category	Lectures hrs/week	Lab/ Assignm hrs/weeks	Credits		Norm		Evaluation (%)	
					GPA	NGPA	GPA	NGPA	CA	WE
CS2150	Graph Theory for Computing	C	2.0	-	2.0				30	70
MA2073	Calculus for System Modelling	C	2.0	-	2.0		19.0		30	70
CS2202	Programming Challenge I	C	-	3/1		1.0			100	-
CS2963	Presentation Skills	C	-	3/1		1.0		2.0	100	-
				Total for Semester 3			19.0	2.0		
Semester 4										
CS3022	Software Engineering	C	2.0	3/1	3.0				40	60
CS3032	Computer Networks	C	2.0	3/1	3.0				40	60
CS3042	Database Systems	C	2.0	3/1	3.0				40	60
MA2033	Linear Algebra	C	2.0	-	2.0				30	70
MA2063	Differential Equations and Applications	C	2.0	-	2.0				30	70
EN2062	Signals & Systems	C	2.0	3/2	2.5		15.5		30	70
DE1xxx	Humanities Elective I	E			2.0		2.0			
CS2212	Programming Challenge II	C	-	3/1		1.0			100	-
CS3953	Technical Writing	C	0.5	3/1		1.5		2.5	100	-
				Total for Semester 4			17.5	2.5		
Semester 5										
CS3202	Software Engineering Project	C		6/1	2.0				100	-
CS3052	Computer Security	C	2.0	-	2.0				40	60
CS3062	Theory of Computing	C	2.0	-	2.0				30	70
CS3242	Micro-controllers and Applications	C	2.0	3/1	3.0				60	40
MN3042	Business Economics & Financial Accounting	C	3.0	-	3.0				30	70
MA3013	Applied Statistics	C	2.0	-	2.0		14.0		30	70
CS3212	Software Architecture and Design	E	2.0	3/1	3.0				40	60
CS3412	Advanced Networking	E	2.0	3/1	3.0				40	60
CS3512	Programming Languages	E	2.0	3/1	3.0				40	60
CS3612	Intelligent Systems	E	2.0	3/1	3.0				40	60
CS3712	Image Processing	E	2.0	3/1	3.0		6.0		40	60
				Total for Semester 5			20.0	0.0		
Industrial Training										
CS3992	Industrial Training	C	-	-		6.0		6.0	100	-
				Total for Industrial Training			0.0	6.0		
Semester 6										
CS4012	Professional Practice	C	2.0	-	2.0				30	70
CS3962	Research and Report Writing	C	0.5	3/2	1.0		3.0		80	20
CS3312	Embedded System Design	E	2.0	3/1	3.0				30	70

Module Code	Module Name	Category	Lectures hrs/week	Lab/ Assignm hrs/weeks	Credits		Norm		Evaluation (%)	
					GPA	NGPA	GPA	NGPA	CA	WE
CS4232	Formal Methods in Software Engineering	E	2.0	3/1	3.0				50	50
CS4242	Human Computer Interaction	E	2.0	3/1	3.0				40	60
CS4532	Concurrent Programming	E	2.0	3/1	3.0				40	60
CS4742	Bioinformatics	E	2.0	3/1	3.0		3.0		40	60
DE2xxx	Humanities Elective II	E			2.0		2.0			
				Total for Semester 6			8.0	0.0		
Semester 7										
CS4202	Research and Development Project	C			5.0				100	-
MN4062	Organizational Behavior and Management	C	2.0	-	2.0		7.0		30	70
CS4222	Software Process and Management	E	2.0	3/1	3.0				50	50
CS4232	Formal Methods in Software Engineering	E	2.0	3/1	3.0				50	50
CS4242	Human Computer Interaction	E	2.0	3/1	3.0				40	60
CS4252	Advanced Operating Systems	E	2.0	3/1	3.0				50	50
CS4262	Distributed Systems	E	2.0	3/1	3.0				50	50
CS4272	Quality Engineering	E	2.0	3/1	3.0				50	50
CS4322	Digital System Design	E	2.0	3/1	3.0				40	60
CS4332	Computer Aided Digital Design	E	2.0	3/1	3.0				40	60
CS4342	Advanced Computer Architecture	E	2.0	3/1	3.0				40	60
CS4352	Robotics and Automation	E	2.0	3/1	3.0				50	50
CS4432	Network and System Administration	E	2.0	3/1	3.0				40	60
CS4442	Current Trends in Networking	E	2.0	3/1	3.0				50	50
CS4462	Computer & Network Security	E	2.0	3/1	3.0				50	50
CS4472	Mobile Computing	E	2.0	3/1	3.0				50	50
CS4482	High Performance Networking	E	2.0	3/1	3.0				40	60
CS4492	Wireless and Broadband Networking	E	2.0	3/1	3.0				40	60
CS4522	Advanced Algorithms	E	2.0	3/1	3.0				40	60
CS4532	Concurrent Programming	E	2.0	3/1	3.0				40	60
CS4542	Compiler Design	E	2.0	3/1	3.0				40	60
CS4552	Scientific Computing	E	2.0	3/1	3.0				40	60
CS4622	Machine Learning	E	2.0	3/1	3.0				50	50
CS4632	Database Internals	E	2.0	3/1	3.0				40	60
CS4642	Data Mining & Information Retrieval	E	2.0	3/1	3.0				40	60
CS4722	Computer Vision	E	2.0	3/1	3.0				40	60
CS4732	Computer Graphics	E	2.0	3/1	3.0				40	60
CS4742	Bioinformatics	E	2.0	3/1	3.0		12.0		40	60

Module Code	Module Name	Category	Lectures hrs/week	Lab/ Assignm hrs/weeks	Credits		Norm		Evaluation (%)	
					GPA	NGPA	GPA	NGPA	CA	WE
				Total for Semester 7			19.0	0.0		
Semester 8										
CS4202	Research and Development Project	C			5.0				100	-
MN4122	Human Resource Management & Industrial Relations	C	2.0	-	2.0		7.0		30	70
CS4222	Software Process and Management	E	2.0	3/1	3.0				50	50
CS4232	Formal Methods in Software Engineering	E	2.0	3/1	3.0				50	50
CS4242	Human Computer Interaction	E	2.0	3/1	3.0				40	60
CS4252	Advanced Operating Systems	E	2.0	3/1	3.0				50	50
CS4262	Distributed Systems	E	2.0	3/1	3.0				50	50
CS4272	Quality Engineering	E	2.0	3/1	3.0				50	50
CS4322	Digital System Design	E	2.0	3/1	3.0				40	60
CS4332	Computer Aided Digital Design	E	2.0	3/1	3.0				40	60
CS4342	Advanced Computer Architecture	E	2.0	3/1	3.0				40	60
CS4352	Robotics and Automation	E	2.0	3/1	3.0				50	50
CS4432	Network and System Administration	E	2.0	3/1	3.0				40	60
CS4442	Current Trends in Networking	E	2.0	3/1	3.0				50	50
CS4452	Information Security & Cryptography	E	2.0	3/1	3.0				50	50
CS4462	Computer & Network Security	E	2.0	3/1	3.0				50	50
CS4472	Mobile Computing	E	2.0	3/1	3.0				50	50
CS4482	High Performance Networking	E	2.0	3/1	3.0				40	60
CS4492	Wireless and Broadband Networking	E	2.0	3/1	3.0				40	60
CS4522	Advanced Algorithms	E	2.0	3/1	3.0				40	60
CS4532	Concurrent Programming	E	2.0	3/1	3.0				40	60
CS4542	Compiler Design	E	2.0	3/1	3.0				40	60
CS4552	Scientific Computing	E	2.0	3/1	3.0				40	60
CS4622	Machine Learning	E	2.0	3/1	3.0				50	50
CS4632	Database Internals	E	2.0	3/1	3.0				40	60
CS4642	Data Mining & Information Retrieval	E	2.0	3/1	3.0				40	60
CS4722	Computer Vision	E	2.0	3/1	3.0				40	60
CS4732	Computer Graphics	E	2.0	3/1	3.0				40	60
CS4742	Bioinformatics	E	2.0	3/1	3.0		9.0		40	60
MA4013	Linear Models and Multivariate Statistics	E	3.0	-	3.0				30	70
MA4023	Operational Research	E	3.0	-	3.0				30	70
MA4033	Time Series & Stochastic Process	E	3.0	-	3.0				30	70
MA4053	Numerical Analysis for Scientific	E	3.0	-	3.0		3.0		30	70

Module Code	Module Name	Category	Lectures hrs/week	Lab/ Assignm hrs/weeks	Credits		Norm		Evaluation (%)	
					GPA	NGPA	GPA	NGPA	CA	WE
	Computing									
Total for Semester 8							19.0	0.0		
Total for the Programme							**137.0**	**13.0**		

Modules Offered to Other Fields of Specialization

Module Code	Module Name	Category	Lectures hrs/week	Lab/ Assignm hrs/weeks	Credits		Norm		Evaluation (%)	
					GPA	NGPA	GPA	NGPA	CA	WE
Semester 2										
CS2812	Visual Programming	-	1.0	3/1	2.0				60	40
CS2842	Computer Systems	-	2.0	-	2.0				40	60
CS2850	Visual Programming & Applications	-	1.0	3/1		2.0			100	-
Semester 3										
CS2832	Modular Software Development	-	1.0	6/1	3.0				50	50
CS2812	Visual Programming	-	1.0	3/1	2.0				60	40
CS2882	Object Oriented Programming using C++	-	2.0	3/1	3.0				30	70

ICE Stream

Module Code	Module Name	Category	Lectures	Lab/ Assignm	Credits		Norm		Evaluation(%)	
			hrs/week	hrs/weeks	GPA	NGPA	GPA	NGPA	CA	WE
Semester 1										
MA1013	Mathematics	C	3.0	1/1	3.0				20	80
CS1032	Programming Fundamentals	C	2.0	3/1	3.0				20	80
ME1032	Mechanics	C	2.0	3/4	2.0				20	80
MT1022	Properties of Materials	C	2.0	3/4	2.0				20	80
CE1022	Fluid Mechanics	C	2.0	3/4	2.0				20	80
EE1012	Electrical Engineering	C	2.0	3/4	2.0				20	80
EL1012	Language Skill Enhancement I	C	-	3/1	1.0		15.0		20	80
MN1012	Engineering in Context	C	1.0	-		1.0		1.0	30	70
Total for Semester 1					**15.0**	**1.0**	**15.0**	**1.0**		
Semester 2										
CS2222	Principles of Embedded Systems Programming	C	2.0	3/1	3.0				40	60
CS2022	Data Structures and Algorithms	C	2.0	3/2	2.5				40	60
CS2052	Computer Architecture	C	2.0	3/1	3.0				40	60
EN1012	Electronic Devices and Circuits	C	2.0	-	2.0				40	60
MA1032	Numerical Methods for Computer Science	C	3.0	-	3.0				30	70
EE2093	Theory of Electricity	C	2.0	-	2.0				30	70
CS2952	Communication Skills	C	0.5	3/1	1.5		17.0		80	20
CS1962	Engineering Skill Development	C	0.5	3/1		1.5		1.5	100	-
DE2xxx	Humanities Elective I	E			2.0		2.0			
Total for Semester 2					**19.0**	**1.5**	**19.0**	**1.5**		
Semester 3										
CS2032	Principles of Computer Communication	C	2.0	3/1	3.0				40	60
CS2232	Real Time Operating Systems	C	2.0	3/2	2.5				40	60

Module Code	Module Name	Category	Lectures	Lab/ Assignm	Credits		Norm		Evaluation(%)	
			hrs/week	hrs/weeks	GPA	NGPA	GPA	NGPA	CA	WE
CS2242	Embedded Software Development	C	2.0	3/1	3.0				40	60
EN2022	Digital Electronics	C	2.0	3/2	2.5				30	70
CE1822	Aspects of Civil Engineering	C	2.0	-	2.0				30	70
ME1822	Basic Engineering Thermodynamics	C	1.5	3/2	2.0				30	70
MA2053	Graph Theory	C	2.0	-	2.0				30	70
MA2073	Calculus for System Modelling	C	2.0	-	2.0		19.0		30	70
CS2972	Automation Challenge I	C	-	3/1		1.0			100	-
CS2963	Presentation Skills	C	-	3/1		1.0		2.0	100	-
Total for Semester 3					**19.0**	**2.0**	**19.0**	**2.0**		
Semester 4										
CS3252	Industrial Computer Engineering	C	2.0	3/1	3.0				40	60
CS3262	Embedded Networks	C	2.0	3/1	3.0				40	60
CS3272	Embedded Database Systems	C	2.0	3/1	3.0				40	60
MA2033	Linear Algebra	C	2.0	-	2.0				30	70
MA2063	Differential Equations and Applications	C	2.0	-	2.0				30	70
ME1802	Introduction to Manufacturing Engineering	C	2.0	3/2	2.5				30	70
EN2062	Signals & Systems	C	2.0	3/2	2.5		18.0		30	70
CS2982	Automation Challenge II	C	-	3/1		1.0			100	-
CS3953	Technical Writing	C	0.5	3/1		1.5		2.5	100	-
Total for Semester 4					**18.0**	**2.5**	**18.0**	**2.5**		
Semester 5										
CS3282	Industrial Computer Engineering Project	C		6/1	2.0				100	-
CS3052	Computer Security	C	2.0	-	2.0				40	60
CS3242	Micro-controllers and	C	2.0	3/1	3.0				30	70

Module Code	Module Name	Category	Lectures	Lab/ Assignm	Credits		Norm		Evaluation(%)	
			hrs/week	hrs/weeks	GPA	NGPA	GPA	NGPA	CA	WE
	Applications									
CS3322	Computer-integrated Control System Applications	C	2.0	-	2.0				40	60
MN3042	Business Economics & Financial Accounting	C	3.0	-	3.0				30	70
CS3612	Intelligent Systems	C	2.0	3/1	3.0				40	60
CS3332	Industrial Instrumentation & Control	C	2.0	3/1	3.0				40	60
MA3013	Applied Statistics	C	2.0	-	2.0		20.0		30	70
Total for Semester 5					**20.0**	**0.0**	**20.0**	**0.0**		
Industrial training										
CS3992	Industrial Training	C	-	-		6.0		6.0	100	-
Total for Industrial Training					**0.0**	**6.0**	**0.0**	**6.0**		
Semester 6										
CS4012	Professional Practice	C	2.0	-	2.0				30	70
CS3962	Research & report Writing	C	0.5	3/2	1.0		3.0		80	20
CS3412	Advanced Networking	E	2.0	3/1	3.0				40	60
CS3712	Image Processing	E	2.0	3/1	3.0				40	60
CS4232	Formal Methods in Software Engineering	E	2.0	3/1	3.0				40	60
CS4242	Human Computer Interaction	E	2.0	3/1	3.0		3.0		40	60
DE2xxx	Humanities Elective II	E	2.0	3/1	2.0		2.0			
Total for Semester 6					**0.0**	**0.0**	**8.0**	**0.0**		
Semester 7										
CS4202	Research and Development Project	C			5.0				100	-
CS4362	Hardware Description Languages	C	2.0	3/1	3.0				40	60
CS4372	Machine Vision	C	2.0	3/1	3.0				40	60
MN4062	Organizational Behaviour and Management	C	2.0	-	2.0		13.0		30	70

Module Code	Module Name	Category	Lectures	Lab/ Assignm	Credits		Norm		Evaluation(%)	
			hrs/week	hrs/weeks	GPA	NGPA	GPA	NGPA	CA	WE
CS4322	Digital System Design	E	2.0	3/1	3.0				40	60
CS4492	Wireless and Broadband Networking	E	2.0	3/1	3.0				40	60
CS4432	Network and System Administration	E	2.0	3/1	3.0				40	60
CS4642	Data Mining & Information Retrieval	E	2.0	3/1	3.0				40	60
CS4732	Computer Graphics	E	2.0	3/1	3.0		6.0	0.0	40	60
Total for Semester 7					**19.0**	**0.0**	**19.0**	**0.0**		
Semester 8										
CS4202	Research and Development Project	C			5.0				100	-
CS4352	Robotics and Automation	C	2.0	3/1	3.0				50	50
MN4122	Human Resource Management & Industrial relations	C	2.0	-	2.0		10.0		30	70
CS4242	Human Computer Interaction	E	2.0	3/1	3.0				40	60
CS4462	Computer & Network Security	E	2.0	3/1	3.0				40	60
CS4332	Computer Aided Digital Design	E	2.0	3/1	3.0				40	60
CS4472	Mobile Computing	E	2.0	3/1	3.0				50	50
CS4262	Distributed Systems	E	2.0	3/1	3.0		6.0		50	50
MA4013	Linear Models and Multivariate Statistics	E	3.0	-	3.0				30	70
MA4023	Operational Research	E	3.0	-	3.0				30	70
MA4033	Time Series & Stochastic Process	E	3.0	-	3.0		3.0	0.0	30	70
Total for Semester 8					**19.0**	**0.0**	**19.0**	**0.0**		
Total for the Programme					**137.0**	**13.0**	**137.0**	**13.0**		

Module Code	CS 1962	Module Title	Engineering Skill Development			
Credits	2.0	Hours/Week	Lectures	1	Pre – requisites	None
GPA/NGPA	NGPA		Lab/Assignments	3		

Learning Outcomes

After completing this module, students should be able to

- explain basic engineering design process
- demonstrate the ability to solve a problem in the engineering domain using engineering design process
- demonstrate the understanding on technologies commonly used in the disciplines of engineering
- demonstrate the ability to use technologies specific to computer science and engineering

Outline Syllabus

- Design Principles
  - Introduction to Engineering Design
  - Life Cycles of Engineering products and processes
  - Design process and Design Tools
  - Concurrent Engineering, Creativity and Reasoning
  - Analysis, synthesis, simulation, evaluation and Decision Making.
- Teaching of basic tools (workshop, drawing, AUTOCAD, PSpice etc)
- Training on some tools and technologies specifically related to computer science such as web development technologies, programming languages and the installation and configuration of popular operating systems.
- Construction of a given product utilising the above experience.
- Design Assignments

  The design assignment is formulated to develop the application of design concepts to engineering problems. Through a simple design, the students are expected to develop teamwork, innovation, choice of materials, survey skills, pricing and marketing skills and manufacture. The project will include:
  - gathering of data and infom1ation from various sources as a preliminary to the design
  - preparing a work plan and delegating duties
  - working with others and to produce results by given deadlines and within given costs
  - learning the basic procedures required for conceptual, preliminary and detailed designs
  - learning the importance or the cost component in the manufacturing process
  - preparing a report and making a presentations on the work done
  - demonstrating the working of the prototype.

Module Code	CS 2012	Module Title	Principles of Object Oriented Programming			
Credits	3.0	Hours/Week	Lectures	2	Pre – requisites	CS1032
GPA/NGPA	GPA		Lab/Assignments	3		

Learning Outcomes

- After completing this module, students should be able to
- analyse a system and decompose it into components based on object-oriented concepts
- implement a collection of objects and compose a system that function according to object-oriented program design
- analyse an object-oriented system and extend or modify functionality while preserving maintainability and correctness

Outline Syllabus

- **Philosophy of object-orientation**
  - Abstraction
  - Encapsulation and information-hiding
  - Separation of behaviour and implementation
  - Division of a system into manageable components
  - Reuse and simple interfaces
- **Object-oriented programming**
  - Definition and use of classes
  - Subclasses, inheritance and class hierarchies
  - Polymorphism
- **Object-oriented application development**
  - Java programming language and API
  - Instance creation and scope control
  - Data structures and iterable collections
  - Stream based I/O and object serialization
  - Event handling for interactive programs
  - Concurrent processes and threads

<table>
<tr><td>Module Code</td><td>CS 2022</td><td>Module Title</td><td colspan="4">Data Structures and Algorithms</td></tr>
<tr><td>Credits</td><td>2.5</td><td rowspan="2">Hours/Week</td><td>Lectures</td><td>2</td><td rowspan="2">Pre – requisites</td><td rowspan="2">CS1032</td></tr>
<tr><td>GPA/NGPA</td><td>GPA</td><td>Lab/Assignments</td><td>3/2</td></tr>
<tr><td colspan="7"><u>Learning Outcomes</u>

After completing this module, students should be able to
• analyse the complexity of basic algorithms
• implement and use common data structures
• select appropriate data structures and algorithms for a given situation
• apply basic algorithm design techniques for a given situation</td></tr>
<tr><td colspan="7"><u>Outline Syllabus</u>

• Complexity analysis of algorithms
• Recursion
• Searching
• Sorting
• Basic algorithm design techniques
o Divide-and-conquer
o Greedy approach
o Dynamic Programming
• Basic data structures and operations on them
o Arrays
o Linked lists
o Queues
o Stacks
o Sets
o Trees
o Hash tables
o Graphs
• Introduction to NP-Completeness</td></tr>
</table>

Module Code	CS 2032	Module Title	Principles of Computer Communication			
Credits	3.0	Hours/Week	Lectures	2	Pre – requisites	None
GPA/NGPA	GPA		Lab/Assignments	3		

Learning Outcomes

After completing this module, students should be able to

- explain the theoretical concepts behind data and voice communication
- analyse the application of communication principles in data and voice communication systems
- explain the use of communication principles in network applications

Outline Syllabus

- **Principles of Communications**
  - Frequency, Spectrum and Bandwidth
  - Analog and Digital data
  - Data encoding
  - Modulation
  - Transmission media
  - Transmission lines
  - Radio and microwave transmission
  - Satellite Transmission
  - Optical Fibre
  - Noise and transmission impairments
- **Transmission and Access networks**
  - Multiplexing and transmission hierarchies
  - DSL
  - Ethernet – media and topologies, standards, broadcast and switched, metro Ethernet
  - Wireless access networks – cellular, WLANs
- **Networking Principles**
  - Components of a Network
  - Circuit and packet switching
  - Convergence
- **Switching and routing**
  - Circuit switching
  - Packet switching and routing
  - The Internet Protocol (IP) – addressing and routing
- **Network applications**
  - Principles of network applications: client-server computing, e-mail, World wide web, web-2 applications, Telephony, SMS, MMS etc.
  - Video, Radio and TV broadcasting

Module Code	CS 2042	Module Title	Operating Systems			
Credits	2.5	Hours/Week	Lectures	2	Pre – requisites	CS1032
GPA/NGPA	GPA		Lab/Assignments	3/2		

Learning Outcomes

After completing this module, students should be able to

- illustrate concepts underlying design and implementation of contemporary operating systems, and chose and defend decisions on operating system implementation techniques
- develop system programs that simulate operating system behaviour
- apply knowledge about operating system behaviour to develop application programs
- evaluate decisions regarding selection of OSs for specific tasks

Outline Syllabus

- **Operating system as a virtual machine and a resource manager**
  - Discussion of various aspects of computer operating system implementations
  - Structure of a system call
- **Processes & Threads**
  - Process and Thread models
  - Inter-process communication and synchronization
  - Comparing Processes and Threads
- **Process and Thread scheduling**
  - Scheduling algorithms
  - Multi-processor scheduling
- **Deadlocks**
- **Memory management**
  - Memory model
  - Memory allocation and management techniques (e.g. :free list based management)
  - Segmentation
  - Paging
  - Page table operation
  - Page table design considerations
  - Virtual memory
  - Demand paging
  - Page replacement algorithms
  - Page fault handling
  - TLB implementation
- **IO management and Disk scheduling**
- **File systems**
  - Concept of files and directories
  - Directory structure
  - File system mounting
  - File system implementation
  - Unix and Windows file systems
- **Protection and security**

Module Code	CS 2052	Module Title	Computer Architecture			
Credits	2.5	Hours/Week	Lectures	2	Pre – requisites	CS1032
GPA/NGPA	GPA		Lab/Assignments	3/2		

Learning Outcomes

After completing this module, students should be able to

- list down the components of a computer and their functionalities
- describe how a program is executed in a computer
- sketch designs of controllers for various components in a computer system
- evaluate the performance enhancement mechanisms in computer systems

Outline Syllabus

- **General System Architecture**
- **Instruction Set Architecture**
- **Processors and Architectures**
- **Memory hierarchy**
- **Storage system and I/O Techniques**
- **Performance and Benchmarking**

<table>
<tr><td>Module Code</td><td>CS 2062</td><td>Module Title</td><td colspan="4">Object Oriented Software Development</td></tr>
<tr><td>Credits</td><td>3.0</td><td rowspan="2">Hours/Week</td><td>Lectures</td><td>2</td><td rowspan="2">Pre – requisites</td><td rowspan="2">CS2012</td></tr>
<tr><td>GPA/NGPA</td><td>GPA</td><td>Lab/Assignments</td><td>3</td></tr>
<tr><td colspan="7"><u>Learning Outcomes</u>

After completing this module, students should be able to
• develop clear, concise, and sufficiently formal requirements for extensions to an existing system, based on the true needs of users and other stakeholders
• apply design principles and patterns while designing and implementing systems based on reusable technology
• create UML class diagrams which model aspects of the domain and the software architecture
• create UML sequence diagrams and state machines that correctly model system behaviour</td></tr>
<tr><td colspan="7"><u>Outline Syllabus</u>

• Principles of software engineering
○ Requirements specification and analysis, design, and testing
○ Reusable technologies as a basis for software engineering and use of frameworks and APIs
○ General software design principles
• Object oriented analysis and design using UML
○ Drawing UML class, package and component diagrams
○ User-centred design and use cases
○ Software behaviour representation with sequence diagrams, state machines, and activity diagrams
○ Design patterns
○ Evaluation of designs
• Software architectures
○ Domain-specific modelling
○ Architectural patterns</td></tr>
</table>

Module Code	CS2150	Module Title	Graph Theory for Computing			
Credits	2	Hours/Week	Lectures	2	Pre – requisites	
GPA/NGPA	GPA		Lab/Assignments	0		

Learning Outcomes

After completing this module, the students should be able to

- Apply graph theory to devise various search algorithms and other algorithms used in computing.
- Apply graph theory in other areas of computer science such as simulation, computer networks and data management.
- Evaluate performance of using different graph algorithms and applications of graph theory for efficient software development

Outline Syllabus

- Basic definitions, degree of a vertex, paths, cycles and connectivity.
- Digraphs, relationship graphs, Eulerian and Hamiltonian graphs.
- Shortest path problems: Dijkstra's algorithm.
- Isomorphism of graphs, adjacency, matrices and adjacency lists.
- Planar graphs, coloring of graphs.
- Trees: Properties, spanning trees, rooted trees, binary trees, binary search and applications.
- Evaluation of graph processing algorithms
- Development of efficient software systems using graphs as an abstract data type

<table>
<tr><td>Module Code</td><td>CS 2202</td><td>Module Title</td><td colspan="4">Programming Challenge I</td></tr>
<tr><td>Credits</td><td>1.0</td><td rowspan="2">Hours/Week</td><td>Lectures</td><td>0</td><td rowspan="2">Pre – requisites</td><td rowspan="2">CS2012, CS2022</td></tr>
<tr><td>GPA/NGPA</td><td>NGPA</td><td>Lab/Assignments</td><td>3</td></tr>
<tr><td colspan="7"><u>Learning Outcomes</u>

After completing this module, students should be able to
• design an interactive software
• design a suitable algorithm to fulfil a given task
• plan a group oriented task
demonstrate the skills of handling suitable software tools and technologies</td></tr>
<tr><td colspan="7"><u>Outline Syllabus</u>

• Designing software development projects
• Application domains
• Software development tools and technologies
• Algorithms
• Current trends in interactive programs</td></tr>
</table>

Module Code	CS 2212	Module Title	Programming Challenge II			
Credits	1.0	Hours/Week	Lectures	0	Pre – requisites	CS2062, CS2022
GPA/NGPA	NGPA		Lab/Assignments	3		

Learning Outcomes

After completing this module, students should be able to

- develop interactive programs that have a high level of usability
- apply best coding practices
- contribute effectively for a group oriented task

Outline Syllabus

- **Software project management**
- **Software usability**
- **Game technologies**
- **GUI design**
- **Best coding practices**

Module Code	CS 2222	Module Title	Principles of Embedded Systems Programming			
Credits	3.0	Hours/Week	Lectures	2	Pre – requisites	CS1032
GPA/NGPA	GPA		Lab/Assignments	3/1		

Learning Outcomes

After completing this module, students should be able to

- Explain the broad outlines of embedded systems
- Describe the difference between embedded systems programming and conventional programming
- Apply the basic principles of embedded systems programming
- Demonstrate the practical skills in programming and debugging embedded systems

Outline Syllabus

- **Introduction to embedded systems**
- **Fundamentals of embedded system hardware**
- **Fundamentals of embedded systems programming**
  - How embedded systems programming is different from conventional programming
  - Timing
  - Dealing with memory
  - Handling interrupts
  - Communicating with peripherals
- **Embedded system programming languages**
- **Real-time operating systems (ROTS)**
- **Safety, reliability and fault tolerance**

Module Code	CS 2232	Module Title	Real Time Operating Systems			
Credits	2.5	Hours/Week	Lectures	2	Pre – requisites	CS1032
GPA/NGPA	GPA		Lab/Assignments	3/2		

Learning Outcomes

After completing this module, students should be able to

- Illustrate concepts underlying design and implementation of real time operating systems, and chose and defend decisions on operating system implementation techniques
- Develop system programs that simulate real time operating system behaviour
- Analyse and provide guarantees for timely behaviour of a computer system based on the individual timing requirements of the real-time tasks in the system
- Apply knowledge about operating system behaviour to design safety-critical real-time systems based on application requirements and system limitations

Outline Syllabus

- **Operating system as a virtual machine and a resource manager**
  - Discussion of various aspects of computer operating system implementations
  - Introductions to RTOS characteristics
  - Processor architecture dependant behaviour
  - Structure of a system call
- **Processes & Threads**
  - Process and Thread models
  - Inter-process communication and synchronization
  - Comparing Processes and Threads
  - Timer handling
- **Process and Thread scheduling**
  - Scheduling algorithms
  - Multi-processor scheduling
  - Tasks, tasks states and task scheduling
  - Real time scheduling, interrupts and clocks
- **Real Time Scheduling and Deadlocks**
- **Memory management**
  - Memory models
  - Memory allocation and management techniques
  - Handling of shared data and semaphores
  - Virtual memory and real memory trade-offs for RTOS
- **Protection and security**

Module Code	CS 2242	Module Title	Embedded Software Development			
Credits	3.0	Hours/Week	Lectures	2	Pre – requisites	CS2222
GPA/NGPA	GPA		Lab/Assignments	3/1		

Learning Outcomes

After completing this module, students should be able to

- Describe the main concepts in designing software for embedded systems
- Evaluate the programming techniques used and issues involved in developing embedded real-time software
- Demonstrate the skills of using embedded software development tools

Outline Syllabus

- **Design of embedded real-time software**
  - Embedded software architectures
  - Basic design using an RTOS
- **Real-time kernels**
- **Embedded software applications**
- **Embedded software development tools**
- **Debugging and testing embedded software**
- **Resources available to speed up embedded software development**

Module Code	CS 2952	Module Title	Communication Skills			
Credits	1.0	Hours/Week	Lectures	0	Pre – requisites	None
GPA/NGPA	GPA		Lab/Assignments	3		

Learning Outcomes

After completing this module, students should be able to

- express his/her ideas clearly in written format
- prepare technical documents depending on the target audience (technical or managerial)
- write summaries/concise articles from a given set of resources

Outline Syllabus

- **Writing newspaper articles**
- **Writing reports**
  - technical
  - non-technical (e.g. user documents)
- **Writing essays**
- **Critically evaluating a document**
  - explaining a point
  - agreeing to a point
  - disagreeing to a point
  - defending a decision
- **Writing summaries**

Module Code	CS 2962	Module Title	Presentation Skills			
Credits	1.0	Hours/Week	Lectures	0	Pre – requisites	None
GPA/NGPA	NGPA		Lab/Assignments	3		

Learning Outcomes

After completing this module, students should be able to

- present any given topic clearly through oral presentations
- demonstrate the ability to decide on the appropriate content for the presentation and the length of the presentation
- demonstrate the ability to engage the audience to the presentation
- review speeches and presentations in front of an audience

Outline Syllabus

- **Development of presentations**
- **Carrying out Q&A (Question and Answer) sessions based on the presentation**
- **"Ice-Breaker" sessions in front of the class**
- **Critical evaluation of presentations**
- **Debates**
- **Drama Competition**
- **Impromptu speeches, discussions**
- **Role playing**

Module Code	CS 2972	Module Title	Automation Challenge I			
Credits	1.0	Hours/Week	Lectures	0	Pre – requisites	CS2222, CS2022
GPA/NGPA	NGPA		Lab/Assignments	3		

Learning Outcomes

After completing this module, students should be able to

- Design an embedded software module and related control components for an automation problem
- Design a suitable algorithm to fulfil a given task
- Plan a group oriented task
- Demonstrate the skills of handling suitable software tools and technologies

Outline Syllabus

- **Designing embedded system development projects**
- **Application domains**
- **embedded system development tools and technologies**
- **Algorithms**
- **Current trends in embedded software development**

<table>
<tr><td>Module Code</td><td>CS2982</td><td>Module Title</td><td colspan="4">Automation Challenge II</td></tr>
<tr><td>Credits</td><td>1.0</td><td>Hours/Week</td><td>Lectures</td><td>0</td><td>Pre – requisites</td><td rowspan="2">CS2242, CS2022</td></tr>
<tr><td>GPA/NGPA</td><td>NGPA</td><td></td><td>Lab/Assignments</td><td>3</td><td></td></tr>
<tr><td colspan="7"><u>Learning Outcomes</u>

After completing this module, students should be able to
• Develop an integrated system containing multiple autonomous systems
• Apply best embedded system design practices
• Participate effectively in a group oriented task</td></tr>
<tr><td colspan="7"><u>Outline Syllabus</u>

• Embedded system design project management
• Hardware software co-design approaches
• Coordinated animation systems
• Failsafe and reliable systems
• Embedded system design best practices</td></tr>
</table>

Module Code	CS 3022	Module Title	Software Engineering			
Credits	3.0	Hours/Week	Lectures	2	Pre – requisites	CS2062
GPA/NGPA	GPA		Lab/Assignments	3		

Learning Outcomes

After completing this module, students should be able to

- apply appropriate software engineering processes and techniques depending on the type and nature of the programming project.
- elicit and track formal requirements
- design and architect large scale software systems with appropriate levels of software and component reuse
- apply iterative software engineering principles to develop & deploy different types of software solutions with requisite quality within the budgeted cost and time

Outline Syllabus

- **Overview of software engineering & systems engineering**
- **Software processes**
- **Overview of project management**
- **Requirements engineering**
- **Requirements engineering processes**
- **System modeling**
- **Architectural design & documentation**
- **Architectural structure & styles**
- **User interface design**
- **Rapid software development & software reuse**
- **Overview of distributed systems & vertical enterprise applications, enterprise application integration & service-oriented architecture**
- **Overview of quality management and verification & validation**
- **Software testing**

Module Code	CS 3032	Module Title	Computer Networks			
Credits	3.0	Hours/Week	Lectures	2	Pre – requisites	CS2032 or EN2052
GPA/NGPA	GPA		Lab/Assignments	3		

Learning Outcomes

After completing this module, students should be able to

- explain the different types of computer networks and the concepts behind them
- describe different networking protocols at different levels of protocol stack and relevant standards that define such protocols
- demonstrate the ability to set up networks given the requirements specification

Outline Syllabus

- **Introduction and OSI Model**
- **The Data Link Layer**
  - Data Link Layer concepts, protocols, functions and frame formats
  - Error detection, correction & control
  - ARQ
  - Flow control
  - Introduction to Token Ring, Token Bus, CSMA/CD etc.
- **Wide-Area Networks (WANs)**
  - Leased Lines, Packet switching, X.25, Frame Relay, ATM, MPLS, Metro Ethernet
- **IEEE LAN standards**
  - Introduction to IEEE 802.3/802.4/802.5 and related supplementary standards
- **Network Layer**
  - Basis for specific implementations of network layers such as IP and other networking protocols
- **Internet Protocol**
  - Details of Internet Protocol (datagram), Addressing, ICMP, Routing protocols, CIDR, Subnetting, ARP, DHCP, NAT,
  - IPv6 and its headers, evolution and use of IPv6
- **Transport Layer**
  - Transport layer functions, services, protocols, addressing & ports
  - Client-server communications (connection establishment, data transfer & connection release), multiplexing, etc.
- **Internet Transport Layer protocols**
  - TCP, UDP, header formats, ports and sockets
  - TCP state machine
  - Improvements to TCP
- **Network Management**
  - OSI Management Model
  - NW Management tools
  - Simple Network Management Protocol
- **Network Design**
- **Other networking protocols**

Module Code	CS 3042	Module Title	Database Systems			
Credits	3.0	Hours/Week	Lectures	2	Pre – requisites	CS1032
GPA/NGPA	GPA		Lab/Assignments	3		

Learning Outcomes

After completing this module, students should be able to

- explain the role of database systems in information management
- describe the basic fundamental concepts of data modelling and relational databases
- apply entity-relationship modelling and normalization for simple database requirements
- demonstrate the use of a query language to create, update and query a simple database
- construct simple applications that requires manipulating data in a DBMS

Outline Syllabus

- **Database Design Process & ER Model**
  - Database design and ER diagrams
  - Entities attributes and entity sets, Relationships and relationship sets, Keys and key constraints
  - Entity Vs relationship
  - Conceptual design for large enterprises
- **Relational Model**
  - Introduction to relational model
  - Integrity constraints over relations and enforcing integrity constraints
- **ER Model to Relational Model**
  - Entity sets to tables, Relationship sets to tables
  - Translating relationship sets with key constraints , s with participation constraints
  - Translating weak entities, class hierarchies and ER diagrams with aggregation
- **Normalization**
  - Attributes and anomalies
  - Loss-less join property, Dependency preserving property
  - 1st , 2nd and 3rd Normal Forms and Boyce-Codd Normal Form (BCNF)
- **Relational Algebra and Calculus**
  - Selection and projection
  - Set operations ,renaming, joins, division,
  - Tuple relational calculus, Domain relational calculus
- **Query Languages:**
  - Data Definition Language (DDL), Data Manipulation Language (DML), Data Query Language (DQL)
  - SQL Queries, Logical connectives , Security & authorization in SQL, Transaction processing using SQL, Embedding SQL in general purpose languages
- **Advanced SQL and Database Applications**
  - Embedded SQL, Cursors, Dynamic SQL
  - JDBC, ODBC
  - Stored procedures
- **Data Models**
  - External model, Conceptual model, Internal model and Physical model
- **Introduction to Indexes, Query Optimization, Physical Database Design**

Module Code	CS 3052	Module Title	Computer Security			
Credits	2.0	Hours/Week	Lectures	2	Pre – requisites	CS3022, CS 3032
GPA/NGPA	GPA		Lab/Assignments	0		

Learning Outcomes

After completing this module, students should be able to

- Demonstrate the knowledge of fundamentals of computer and network security
- Describe underlying theories and concepts of security
- Apply access controls, solve Internet related security issues, and to take preventive and reactive measures to deal with computer security issues

Outline Syllabus

- **Introduction to security**
- **Features of security systems**
- **Threats and attacks on security**
- **Introduction to cryptography**
- **Digital signatures**
- **Program level security**
- **Computer system security**
- **Introduction to network security**

Module Code	CS 3062	Module Title	Theory of Computing			
Credits	2.0	Hours/Week	Lectures	2	Pre – requisites	CS2022
GPA/NGPA	GPA		Lab/Assignments	0		

Learning Outcomes

After completing this module, students should be able to

- explain and distinguish the basic models of computation and the Chomsky-hierarchy
- describe the relationship between basic models and corresponding languages
- explain the limitations of basic models and what happens when enhancements (e.g., non-determinism, multiple tapes) are introduced
- describe a Turing Machine and the Church-Turing thesis

Outline Syllabus

- **Overview of Basic models of computation**
- **Finite automata and regular languages**
- **Pushdown automata and context-free languages**
- **Turing machines and their languages**
- **Church-Turing thesis**
- **Complexity, Computability and non-computability**

Module Code	CS 3202	Module Title	Software Engineering Project			
Credits	2.0	Hours/Week	Lectures	0	Pre – requisites	CS2022, CS3022
GPA/NGPA	GPA		Lab/Assignments	6		

Learning Outcomes

After completing this module, students should be able to

- develop a software system
- apply software engineering processes and principles in developing software
- generate relevant software engineering documents
- abstract out important concepts in a project and write a technical paper
- develop software individually

Outline Syllabus

Each student will have to work on an individual semester long programming project while rigorously applying software engineering principles using the latest source code management tools and leveraging specification templates used in the industry. These programming projects would typically entail projects where they have to add components or modify components in a large existing software project.

Students are required to perform the following during the course

- **Understand an iterative software engineering process and the related documentation requirements**
- **Study the potential project idea and present a feasibility report**
- **Design a project plan with at least two iterations and appropriate milestones.**
- **Develop a project vision document**
- **Understand the overall software requirements and write the software requirements specification**
- **Analyze the requirements and create the software architecture and design**
- **Complete the development and demonstrate the project outcomes**
- **Extract the important concepts of the project and write a technical paper**

Module Code	CS 3212	Module Title	Software Architecture and Design			
Credits	3.0	Hours/Week	Lectures	2	Pre – requisites	CS2062, CS3022
GPA/NGPA	GPA		Lab/Assignments	3		

Learning Outcomes

After completing this module, students should be able to

- evaluate a software architecture with respect to strategic vision and goals of an enterprise
- use a range of software design patterns, frameworks and architectures for design of software
- select and apply appropriate metrics to evaluate qualities of a software design including performance, reliability, security, safety, re-usability, complexity, etc.

Outline Syllabus

- **Principles of software architecture**
  - Mapping enterprise strategic vision to architectural modal
  - Architectural modelling through views
  - Evaluation of architectures, design patterns and application frameworks
- **Principles of software design**
  - Modularization of functionality and elicitation of system properties
  - Design strategies and evaluation of designs
  - Cross-cutting concerns in a software design
- **Practice of software architecture and design**
  - Design of distributed systems, component based design and software as a service
  - Documenting software architectures
  - Reuse of architectures
  - Case studies in software architecture and design

Module Code	CS 3242	Module Title	Micro-controllers and Applications			
Credits	3.0	Hours/Week	Lectures	2	Pre – requisites	CS2052
GPA/NGPA	GPA		Lab/Assignments	3		

Learning Outcomes

After completing this module, students should be able to

- Describe the concepts, architecture and limitations of single-chip computers and micro-controllers
- Apply theory of micro-processor based design into real world applications
- Select appropriate interfacing techniques for connecting digital systems to real world problems
- Design, program and debug digital micro-controller based systems

Outline Syllabus

- **Introduction to micro-controllers, difference between micro-controller and microprocessors**
- **Micro-controller architecture**
- **I/O addressing, hand-shaking and timing diagrams**
- **Digital interfacing (Timers, Capture and Compare Units, Master & Salve ports)**
- **Analog interfacing – A/D and D/A converters, PWM converters**
- **Inter device communications – Computer Busses**
- **Micro-controller supervisory circuits**
- **Micro-controller based design techniques**
- **Micro-controller programming techniques**

Module Code	CS 3252	Module Title	Industrial Computer Engineering			
Credits	3.0	Hours/Week	Lectures	2	Pre – requisites	CS2242
GPA/NGPA	GPA		Lab/Assignments	3		

Learning Outcomes

After completing this module, students should be able to

- Apply appropriate industrial systems design and engineering processes and techniques depending on the type and nature of the project.
- Elicit and track functional, environmental and operational requirements
- Design and architect complex multi-modular and multi-layer systems with appropriate levels of software component and hardware component reuse
- Apply hardware software co-design techniques, iterative systems design principles and prototype based implementation methodologies to develop & deploy different types of industrial computer engineering solutions with requisite quality and within the budgeted cost and time

Outline Syllabus

- **Overview of embedded systems engineering**
- **Embedded software processes**
- **Overview of project management**
- **Requirements engineering**
- **Requirements engineering processes**
- **System modelling**
- **Architectural design & documentation**
- **Architectural structure & styles**
- **Hardware software co-design and component reuse**
- **Overview of embedded systems & vertical and horizontal integration for industrial computer engineering applications, modular integration of control systems and embedded systems in enterprise industrial applications**
- **Overview of quality management and verification & validation**
- **Embedded systems and control systems testing**

Module Code	CS 3262	Module Title	Embedded Networks			
Credits	3.0	Hours/Week	Lectures	2	Pre – requisites	CS2032
GPA/NGPA	GPA		Lab/Assignments	3		

Learning Outcomes

After completing this module, students should be able to

- Explain the different types of computer networks and the concepts behind them
- Describe different networking protocols at different levels of protocol stack and relevant standards that define such protocols
- Evaluate use of controller area network (CAN) bus for inter device communication without a host computer
- Demonstrate the ability to set up networks given the requirements specification

Outline Syllabus

- **Introduction and OSI Model**
- **The Data Link Layer**
  - Data Link Layer concepts, protocols, functions and frame formats
  - Error detection, correction & control
  - ARQ
  - Flow control
  - Introduction to Token Ring, Token Bus, CSMA/CD, CAN bus etc.
- **Wireless Networks and Sensor Networks**
  - Introduction to IEEE 802.11, IEEE 1451 and ZigBee/802.15.4 and related supplementary standards
- **IEEE LAN standards**
  - Introduction to IEEE 802.3/802.4/802.5 and related supplementary standards
- **Network Layer**
  - Basis for specific implementations of network layers such as IP and other networking protocols
  - Details of Internet Protocol (datagram), Addressing, ICMP, Routing protocols, CIDR, Subnetting, ARP, DHCP, NAT,
  - IPv6 and its headers, evolution and use of IPv6
  - Using IP networks for SCADA
- **Transport Layer**
  - Transport layer functions, services, protocols, addressing & ports
  - Client-server communications (connection establishment, data transfer & connection release), multiplexing, etc.
  - TCP, UDP, header formats, ports and sockets
  - TCP state machine
  - Improvements to TCP
- **Network Design and Management**

Module Code	CS 3272	Module Title	Embedded Database Systems			
Credits	3.0	Hours/Week	Lectures	2	Pre – requisites	CS1032
GPA/NGPA	GPA		Lab/Assignments	3		

Learning Outcomes

After completing this module, students should be able to

- Explain the role of embedded databases in information management
- Describe the use of Embedded Databases for mobile, context-aware very small databases, resident on smart cards, PADs, cellular phone SIM cards or Wireless Sensors.
- Explain the importance of data consistency, concurrency control, query processing, optimization, recovery management in Embedded Databases.
- Demonstrate the use of a query language to create, update and query a simple database.
- Construct simple applications that require manipulating data in an Embedded Database.

Outline Syllabus

- **Introduction to Traditional Database Management Systems**
- **Data Modelling**
- **Relational Algebra and Calculus**
- **Database Query Languages**
- **Introduction to Transaction Processing.**
- **Active real time database systems**
- **Main memory databases**
- **Embedded database system architectures.**
- **Applications of Embedded databases**

Module Code	CS 3282	Module Title	Industrial Computer Engineering Project			
Credits	2.0	Hours/Week	Lectures	0	Pre – requisites	CS2022, CS3252
GPA/NGPA	GPA		Lab/Assignments	6/1		

Learning Outcomes

After completing this module, students should be able to

- Develop an embedded automation system
- Apply embedded system engineering processes and principles in developing the automation
- Generate relevant embedded system engineering documents
- Write a technical paper by eliciting important concepts relevant in a project
- Develop an embedded system individually

Outline Syllabus

Each student will have to work on an individual semester long embedded system design and implementation project while rigorously applying industrial computer engineering principles using the latest development tools and leveraging specification templates used in the industry. These systems development projects would typically entail projects where they have to add components or modify components in a large existing automation project.

Students are required to perform the following during the course

- **Understand an embedded system engineering process and the related documentation requirements**
- **Study the potential project idea and present a feasibility report**
- **Design a project plan with at least two iterations and appropriate milestones.**
- **Develop a project vision document**
- **Understand the overall embedded system requirements and write the embedded system requirements specification**
- **Analyze the requirements and create the software architecture and design**
- **Complete the development and demonstrate the project outcomes**
- **Extract the important concepts of the project and write a technical paper**

Module Code	CS 3312	Module Title	Embedded System Design			
Credits	3.0	Hours/Week	Lectures	2	Pre – requisites	CS2042, EN1022, CS 2052
GPA/NGPA	GPA		Lab/Assignments	3		

Learning Outcomes

After completing this module, students should be able to

- explain the design concepts of embedded systems and "System On Chip" designs
- model real world systems into embedded systems
- design, model and simulate embedded systems
- explain the design and implementation constraints of embedded systems
- explain the economics of embedded systems design and implementation

Outline Syllabus

- **Introduction to embedded applications and "System on Chip" implementations**
- **High-level modelling of real world systems (Black box models and glass-box models)**
- **System level models (Data-flow, Behavioural and architectural models)**
- **Hardware – software co-design**
- **Providing real-time response**
- **Error handling, fail-safe and supervisory techniques**
- **Power management**
- **Simulation, prototyping and testing methods for embedded applications**

Module Code	CS 3322	Module Title	Computer-integrated Control System Applications			
Credits	2.0	Hours/Week	Lectures	2	Pre – requisites	EN2062
GPA/NGPA	GPA		Lab/Assignments	0		

Learning Outcomes

After completing this module, the students should be able to

- Describe the concept of system control and use of feedback
- Model and analyse computer-integrated control systems
- Explain system stability
- Design computer integrated control systems using modular approaches
- Evaluate application specific performance criteria of computer integrated control systems

Outline Syllabus

- Introduction to system control and system modelling
  - Centralized, distributed and hierarchical control systems, SCADA systems, sensors used in computer control
- Programming of micro-controllers for system control
- Sampled data systems and transforms
- System time response characteristics
  - Time response comparison, time domain specifications and programming for constrained environments
- Study of system stability
- Elements of discrete controller design and system integration with digital controllers
- Controller realization techniques
  - Direct structure, direct canonical structure, direct non-canonical structure, cascade realization, parallel realization, PID controller implementations, micro-controller implementations
- Reliable system development Strategies
  - System control for fail-safe and fault-tolerant systems
- Tools for modelling and simulation of system controls
- Application examples

Module Code	CS 3332	Module Title		Industrial Instrumentation and Control		
Credits	3.0	Hours/Week	Lectures	2	Pre – requisites	CS3252
GPA/NGPA	GPA		Lab/Assignments	3/1		

Learning Outcomes

After completing this module, the students should be able to

- Explain basic principles of operation of instruments
- Discuss how to improve the accuracy of measurements in industrial environments
- Define and integrate components into systems that monitor and control the process
- Identify the control theory aspects in measurements
- Apply instrumentation principles to specify industrial instruments, sensors and actuators for practical engineering processes, situations and problems.
- Discuss current and future technological trends in industrial engineering

Outline Syllabus

- **General Measurement theory**
  - Introduction to measurement theory
  - Measurement errors
  - Error reduction techniques.
  - Signal and noise in measurement systems
- **Industrial sensors**
  - Description, performance specification of sensors of Temperature, Pressure, Displacement, Level and Flow
- **Signal Conditioning**
  - Bridge conditioning
  - Electronic conditioning
  - Errors in conditioning
  - Noise in amplification
- **Instrumentation standards and practice**
  - Instrumentation terminology
  - Electrical and pneumatic transmission systems
  - Noise considerations
  - Grounding and shielding
- **Introduction to practical industrial controllers**
  - PID controller implementation
  - Feed-forward considerations
  - Trial and error tuning of PID controllers
  - Model based tuning of PID controller

Module Code	CS 3412	Module Title	Advanced Networking			
Credits	3.0	Hours/Week	Lectures	2	Pre – requisites	CS3032
GPA/NGPA	GPA		Lab/Assignments	3		

Learning Outcomes

After completing this module, the students should be able to

- demonstrate the knowledge of the operation of current networking technologies
- show the application of different networking technologies in implementing networks

Outline Syllabus

- **Theory and implementation of the following technologies, and any other new technology introduced from time to time:**
  - Wireless networking technologies – WiFi, WiMax, 3G/4G
  - DSL technologies
  - Metro Ethernet
  - Frame Relay, ATM
  - Fibre Channel
  - EFM, FTTx
  - MPLS
  - VLANs, VPNs
  - SANs

Module Code	CS 3512	Module Title	Programming Languages			
Credits	3.0	Hours/Week	Lectures	2	Pre – requisites	CS2012, CS2022
GPA/NGPA	GPA		Lab/Assignments	3		

Learning Outcomes

After completing this module, the students should be able to

- explain the principles behind the design of programming languages and compilers
- compare different programming paradigms

Outline Syllabus

- **Compilation and Interpretation Concepts**
  - Syntax specification, scanning & parsing
  - Names, scopes and bindings
  - Semantic analysis
  - Target Machine Architecture
- **Programming Language Design Issues**
  - Control flow
  - Data types
  - Subroutines and control abstraction
  - Data abstraction and object orientation
- **Alternative Programming Models**
  - Functional languages - Scheme
  - Logic languages - Prolog
  - Concurrent Programming
  - Scripting Languages
- **Programming Language Implementation**
  - Compiler structure, intermediate code, code generation, assembly & linking
  - Runtime program management
  - Code improvement

Module Code	CS 3612	Module Title	Intelligent Systems			
Credits	3.0	Hours/Week	Lectures	2	Pre – requisites	CS2022
GPA/NGPA	GPA		Lab/Assignments	3		

Learning Outcomes

After completing this module, students should be able to

- recognise the unique problems which AI attempts to solve
- explain underlying issues and commonly used AI techniques and strategies adopted to create intelligent programs
- analyse and select the most efficient and appropriate mechanism applicable to a given problem that can be solved using AI

Outline Syllabus

- **Introduction and Fundamental Issues**
- **Intelligent agents**
- **Intelligent search techniques**
- **Games as search problems**
- **Learning and Knowledge Representation**
- **Language and programming techniques for AI**
- **Artificial planning and learning techniques**

Module Code	CS 3712	Module Title	Image Processing			
Credits	3.0	Hours/Week	Lectures	2	Pre – requisites	CS2022
GPA/NGPA	GPA		Lab/Assignments	3		

Learning Outcomes

After completing this module, students should be able to

- describe the human image perception mode
- apply qualitative and quantitative image fidelity criterions
- describe types of noise in images and noise removal techniques
- describe and apply image quality enhancement techniques
- describe principles of image compression models and apply image compression techniques
- apply principles of digital video

Outline Syllabus

- **Introduction to human vision system**
- **Image fidelity criterions**
- **Digital image acquisition methods**
- **Point and neighbourhood operations**
- **Types of noise and noise removal techniques**
- **Image transforms and enhancement**
- **Image compression (lossy and lossless compression)**
- **GIF and JPEG standards**
- **Principles of digital video**
- **MPEG video compression standard**

Module Code	CS 3953	Module Title	Technical Writing			
Credits	1.5	Hours/Week	Lectures	0.5	Pre – requisites	None
GPA/NGPA	NGPA		Lab/Assignments	3		

Learning Outcomes

After completing this module, students should be able to

- Explain the important aspects of writing required in the world of technically-oriented professions
- Develop the practical knowledge & capability to successfully communicate technical information in a manner adapted to the needs, levels of understanding and background of the readers/audience

Outline Syllabus

- **Document Design**
- **Technical Writing Process**
  - Audience analysis
  - Topic ideas, brainstorming, narrowing & outlining
  - Note taking & rough-drafting
  - Power-revision techniques
  - Libraries, documentation & cross-referencing
  - Strategies for peer-reviewing and team-writing
- **Technical Writing Guidelines**
  - Basic patterns and elements of a sentence
  - Common grammar, usage & punctuation problems
  - Common spelling problems
- **Technical Writing Scenarios & Applications**
  - Types of technical reports & different types of content (interface, reference, descriptive, conceptual and procedural information etc.)
  - Proposals
  - Progress Reports
  - Instructions
  - User Guides
  - Organizational policies & procedures
  - Feasibility, evaluation & recommendation reports
  - Technically-oriented articles (descriptive, definitive, causal, process, classification & comparison oriented communication)
  - Business plans
  - Writing abstracts, introductions & conclusions

Module Code	CS 3962	Module Title	Research & Report Writing			
Credits	1.0	Hours/Week	Lectures	0.5	Pre – requisites	None
GPA/NGPA	GPA		Lab/Assignments	3/2		

Learning Outcomes

After completing this module, students should be able to

- build and write an argument that would motivate the readers to accept their claims
- explain how to anticipate reader reservations and formulate appropriate responses accordingly
- write suitable introductions and conclusions in formal technical research reports
- demonstrate the practical ability to effectively plan, reason and write good reports

Outline Syllabus

- **Researcher as a writer**
  - The uses of research – public & private
  - Connecting with the reader
- **Planning a project**
- **Assembling a research argument**
  - Overview of making good arguments
  - Making & evaluating claims
  - Assembling reasons & evidence
  - Deciding acknowledgements and framing responses
  - Warrants
- **Components of a formal report**
- **Mechanics of writing styles**
- **Planning, drafting, writing and revising a report**
  - Common flaws in planning a report
  - Drafting a report
  - Quoting, paraphrasing, summarising & preventing accidental plagiarism
  - Thinking like a reader
  - Revising arguments and report organization
  - Communicating evidence visually
  - Introductions & conclusions
  - Principles of clear writing styles

Module Code	CS 3992	Module Title	Industrial Training			
Credits	6.0	Hours/Week	Lectures	-	Pre – requisites	None
GPA/NGPA	NGPA		Lab/Assignments	-		

Learning Outcomes

After completing this module, the students should be able to

- explain the role and contribution of industry for the national development
- recognize the professional realities of the industrial environment that complement, enhance, confirm, and reshape knowledge
- appreciate the formal and informal relationships in an industrial organization and demonstrate essential skills on human relations and team work
- demonstrate the ability to appreciate the complex nature of industrial problems and relate theoretical concepts learnt to practices in the industry in obtaining optimum solutions.
- appreciate the application and synergy of engineering, management, financial and economic aspects in the real world.
- demonstrate the ability to cultivate powers of observation and make use of the facilities provided to fulfil the needs of the industry.
- demonstrate the sense of responsibility towards industry and society in general

Outline Syllabus

- **Orientation/Familiarization with the Industrial Training Organization**
  - Overall function/role/scope of the organization in the respective sector
  - Scale/magnitude of the organization in the respective sector in the country/region
  - Structure of the organization with respective to the discharge of different functions
  - Nature and scope of different engineering disciplines in respective divisions/departments.
- **Planning & designing of engineering products, process and projects and effecting.**
  - Research and concept development
  - Process of matching the client needs, equipment/component/device/ selection, tender procedures and analyse the requirements of the system or software
  - Prepare the design and the specification and evaluation of technical design details with respect to planning process based on need of the clients.
  - Managing and planning a Project
  - Costing and financing
  - Forecasting of human resource requirement and development
  - Setting up Disaster recovery techniques
  - Assuring Data protection and analyse the security and other risks.
  - Coding to implement the system
  - Testing and assuring the quality of the system
  - Prepare documentation on System or Application Software and user manuals.
  - Familiarize with systems
  - Commissioning procedures
  - Installation and testing
  - Use of tools
  - Installing System / Network installation
  - Managing System / Network and Troubleshooting.
- **Skills of functioning as an effective Engineer in the Industry**
  - Acquisition of professional ethics in an industry set up (transition from academic life to industry set up)
  - Working with non – engineers ranging from labourers to Chief Executives possessing vastly different education
  - Social and cultural experiences and backgrounds and becoming a team player and a leader
  - Earning the respect of all by demonstrating the engineering knowledge appropriately
  - Management, organization and labour rules and regulations.

Module Code	CS4012	Module Title	Professional Practice			
Credits	2.0	Hours/Week	Lectures	2	Pre – requisites	None
GPA/NGPA	GPA		Lab/Assignments	0		

Learning Outcomes

After completing this module, students should be able to

- explain ethical and moral obligation of an engineer
- analyze social and professional issues that arise in the practice of computing

Outline Syllabus

- **Engineering ethics and value systems**
- **Technology-driven changes to public policy**
- **Technology, law and the working environment**
- **Law and intellectual properties**
- **Community standards and personal responsibility**

Module Code	CS 4202	Module Title	Research and Development Project			
Credits	10.0	Hours/Week	Lectures	-	Pre – requisites	CS1962, CS3202, CS3992
GPA/NGPA	GPA		Lab/Assignments	8		

Learning Outcomes

After completing this module, the students should be able to

- Demonstrate the knowledge gained through research
- Demonstrate the skills in planning, documenting, project management and teamwork
- Demonstrate the developed project

Outline Syllabus

- **Project requirement gathering**
- **Preparation of project requirement specifications**
- **Project planning**
- **Software, hardware or system design (depending on the project)**
- **Acquiring domain knowledge through literature survey or by working with the industry**
- **Researching on current and past development and research work done by others**
- **Development of necessary skills for project implementation**
- **Prototyping the system**
- **Development of the system using the skills acquired**
- **Validation and testing of the development**
- **Periodic reporting and presentations**
- **Project report writing**
- **Research paper writing**

Module Code	CS 4222	Module Title	Software Process and Management			
Credits	3.0	Hours/Week	Lectures	2	Pre – requisites	CS3022
GPA/NGPA	GPA		Lab/Assignments	3		

Learning Outcomes

After completing this module, students should be able to

- evaluate frameworks for managing the quality of software work processes and software products with respect to target processes and products
- analyse methodologies for managing software projects and design customized plans for project management
- develop a comprehensive project plan based on standards for software process management

Outline Syllabus

- **Principles of software processes**
  - Relationship between software requirements evolution and process frameworks
  - Software process concepts and models
  - Process implementation
- **Software process quality**
  - Quality concepts and cultural aspects
  - Standards for quality of software processes an d modelling of cost of quality
  - Metrics for evaluation of quality
- **Project management**
  - Management models and impact on software processes
  - Project planning for resource allocation and risk management
  - Project control through measurement and analysis of results

Module Code	CS 4232	Module Title	Formal Methods in Software Engineering			
Credits	3.0	Hours/Week	Lectures	2	Pre – requisites	CS3022
GPA/NGPA	GPA		Lab/Assignments	3		

Learning Outcomes

After completing this module, students should be able to

- create mathematically precise specifications and design for software using formal languages
- analyse the properties of formal specifications and designs for evaluation of quality and validation for compliance with requirements
- use tools to transform specifications and designs

Outline Syllabus

- **Concepts of formal methods**
  - Formal methods as a paradigm for higher quality software design and construction
  - Mathematical foundations, logic calculi and automata theory
  - Proofs of correctness for specifications and designs using formal methods
  - Validation of a formal model against implementable systems
- **Practice of formal models**
  - Types of models, formal languages, type systems and program semantics
  - Automated proof systems using theorem proving and model checking
  - Transformation of programs for formal analysis and verification
  - Analysis of software using formal methods
- **Integration of formal methods to software engineering processes**
  - Formal methods use in requirements analysis, refinement and testing
  - Reusable models and theories

<table>
<tr><td>Module Code</td><td>CS4242</td><td>Module Title</td><td colspan="4">Human-Computer Interaction</td></tr>
<tr><td>Credits</td><td>3.0</td><td rowspan="2">Hours/Week</td><td>Lectures</td><td>2</td><td rowspan="2">Pre – requisites</td><td rowspan="2">CS2012, CS2022</td></tr>
<tr><td>GPA/NGPA</td><td>GPA</td><td>Lab/Assignments</td><td>3</td></tr>
<tr><td colspan="7"><u>Learning Outcomes</u>

After completing this module, the students should be able to
• explain why good HCI design is needed
• identify the relevant characteristics of humans and computers
• demonstrate a knowledge of HCI concepts
• design high quality user interfaces</td></tr>
<tr><td colspan="7"><u>Outline Syllabus</u>

• Relevant characteristics of humans and computers
• The interaction between humans and systems
• Interaction design
• HCI in the software process
• Universal design and localisation
• User support
• HCI Design Project</td></tr>
</table>

<table>
<tr><td>Module Code</td><td>CS4252</td><td>Module Title</td><td colspan="4">Advanced Operating Systems</td></tr>
<tr><td>Credits</td><td>3.0</td><td rowspan="2">Hours/Week</td><td>Lectures</td><td>2</td><td rowspan="2">Pre – requisites</td><td rowspan="2">CS2042</td></tr>
<tr><td>GPA/NGPA</td><td>GPA</td><td>Lab/Assignments</td><td>3</td></tr>
<tr><td colspan="7"><u>Learning Outcomes</u>

After completing this module, the students should be able to
• explain design strategies required to provide functionality beyond basic OS services
• critically evaluate a specified advanced operating system
• synthesise an evaluation criteria for an OS targeted for a non-conventional environment</td></tr>
<tr><td colspan="7"><u>Outline Syllabus</u>

• Design concepts and features of different operating systems
• Advanced functions of operating systems
• Synchronization and communication
• File systems design
• Protection and security
• Operating system structure and extension techniques
• Fault tolerance
• Distributed operating systems</td></tr>
</table>

Module Code	CS4262	Module Title	Distributed Systems			
Credits	3.0	Hours/Week	Lectures	2	Pre – requisites	CS2042, CS3032
GPA/NGPA	GPA		Lab/Assignments	3		

Learning Outcomes

After completing this module, students should be able to

- Explain the nature & characteristics of distributed systems
- Identify how and when to apply particular distributed algorithms and techniques
- Evaluate the latest distributed computing technology & application trends

Outline Syllabus

- **Characterization of distributed systems**
- **Distributed system architectural and fundamental models**
- **Network communication**
- **Communication models**
- **Distributed computing applications**
- **Distributed computing middleware**
- **Time, synchronization and global states**
- **Coordination and agreement**
- **P2P systems and grid computing**
- **Transactions and concurrency control**
- **Consistency and replication**

Module Code	CS4272	Module Title	Quality Engineering			
Credits	3.0	Hours/Week	Lectures	2	Pre – requisites	CS3022
GPA/NGPA	GPA		Lab/Assignments	3		

Learning Outcomes

After completing this module, students should be able to

- explain quality management process activities such as quality assurance, quality planning and quality control
- explain how measurements help in assessing quality attributes and the differences between predictor and control metrics
- distinguish between software verification and validation techniques and between validation testing and defect testing
- explain the principles of system testing and component testing

Outline Syllabus

- **Principles of software verification and validation**
- **Software quality metrics**
- **Project quality management**
  Defect management process, defect removal effectiveness
- **Software inspection and testing**
- **Fundamentals**
  Concepts and context, risk analysis, goals, process, and psychology
- **Lifecycle testing**
  How testing relates to development including models, verification and validation, and types of tests
- **Static testing**
  Reviews, inspections, and static tools
- **Non-functional testing**
- **System and component testing**
- **Test design techniques**
  Black-box test methods, white-box techniques, error guessing, and exploratory testing
- **Test management**
  Team organization, key roles and responsibilities, test strategy and planning, test execution documentation, configuration management
- **Testing tools**
  Tool selection, benefits, risks, and classifications
- **Continuous integration and automated testing**
- **Cost of software quality**
- **Maturity models for software test process assessment and improvement**

Module Code	CS4322	Module Title	Digital Systems Design			
Credits	3.0	Hours/Week	Lectures	2	Pre – requisites	EN2022
GPA/NGPA	GPA		Lab/Assignments	3		

Learning Outcomes

After completing this module, the students should be able to

- Design complex constrained digital systems using modular MSI/LSI components
- Describe modern digital design techniques such as architectural state machine design and the use of re-configurable design blocks
- Use hardware description language VHL for modelling and synthesis of digital systems

Outline Syllabus

- **Structured design concept. Design strategies. Design decomposition. And design with architectural components.**
- **Introduction to VHDL**
- **Basic VHDL modelling techniques.**
- **Data flow modelling**
- **Behavioural modelling**
- **Structural modelling**
- **Design synthesis and verification**
- **Digital design project.**

Module Code	CS4332	Module Title	Computer Aided Digital Design			
Credits	3.0	Hours/Week	Lectures	2	Pre – requisites	EN2022
GPA/NGPA	GPA		Lab/Assignments	3		

Learning Outcomes

After completing this module, students should be

- able to identify why computer-aided design is necessary and its impact on the design process of modern digital systems
- familiar with some commonly used computer-aided design tools, their main features/capabilities and limitations
- aware of the basic concepts about hardware description languages (HDLs)
- able to model and synthesize digital systems using HDLs

Outline Syllabus

- **Architectural and modular modelling of digital systems**
  - PLA and PAL architectures
  - LUT based synthesis / modelling of digital systems
  - Synchronous and Asynchronous systems
  - ASM notation for State machine based modelling
- **Advanced programmable logic devices**
  - Introductions to structures of CPLD and FGPA devices
  - ASICs
- **Introduction to VHDL**
  - Capabilities, Terminology and Synthesis process engine (Design Entry, Synthesis, Implementation, Timing and Functional verification)
  - Introduction to Xilinx VHDL design environment
- **VHDL Elements**
  - Data objects, types & operators
  - Concurrent and sequential statements Styles of modelling
  - Behavioural, data flow and structural modelling of Digital Systems.
- **Logic-level Synthesis and Optimization**
  - Two-level logic optimization: exact and approximate methods
  - Binary Decision Diagrams
  - Multi-level logic optimization: methods and tools
  - Sequential logic: synthesis and optimization
- **Testing of digital systems and design for testability**

Module Code	CS 4342	Module Title	Advanced Computer Architecture			
Credits	3.0	Hours/Week	Lectures	2	Pre – requisites	CS2052 or EN2022
GPA/NGPA	GPA		Lab/Assignments	3		

Learning Outcomes

After completing this module, students should be able to

- provide comprehensive detailed explanations of the design concepts and considerations behind today's microprocessors
- analyze the current and potential future development in computer systems technology
- critically evaluate the design concepts of modern multiprocessor systems
- relate operations of compilers and applications to processor architectures

Outline Syllabus

- **Fundamental Concepts**
- **Simple Pipelined RISC Processors**
- **Extending Simple Pipelined RISC Processors**
- **ILP and Superscalar processors**
- **Extracting ILP with Compiler Support**
- **Memory Hierarchy**
- **Multiprocessors and Thread Level Parallelism (TLP)**
- **Input/Output and Storage Systems**

Module Code	CS4352	Module Title	Robotics and Automation			
Credits	3.0	Hours/Week	Lectures	2	Pre – requisites	CS3242
GPA/NGPA	GPA		Lab/Assignments	3		

Learning Outcomes

After completing this module, students should be able to

- explain the relationship between mechanical structures and their operational workspace characteristics
- apply spatial transformation to obtain forward kinematics equation of robot manipulators
- solve inverse kinematics of simple robot manipulators and generate joint trajectory for motion
- evaluate robot controllers for the purpose of interfacing robots to computer systems

Outline Syllabus

- **Different types of robots, robotic Structure, workspaces and applications**
- **Degrees of freedom and spatial transformations**
- **Orientation matrices, representation of robots in mathematical space**
- **Forward kinematics and inverse kinematics**
- **Trajectory planning and generation**
- **Interfacing robots**
- **Hands-on session on programming an industrial robot**

Module Code	CS4362	Module Title	Hardware Description Languages			
Credits	3.0	Hours/Week	Lectures	2	Pre – requisites	
GPA/NGPA	GPA		Lab/Assignments	3		

Learning Outcomes

After completing this module, the students should be able to

- Use common hardware description languages such as Verilog / VHDL to design, describe and simulate large scale digital systems

Outline Syllabus

- **Review of Digital Logic Design**
- **Hardware Abstraction techniques**
- **Study of Algorithmic State Machines (ASMs)**
- **Introduction to Hardware Description Languages**
- **Data-flow style modelling of digital systems**
- **Behavioural modelling of digital systems**
- **Working with large systems – structural modelling**
- **Functional and Timing simulation of digital systems**

Module Code	CS4372	Module Title	Machine Vision			
Credits	3.0	Hours/Week	Lectures	2	Pre – requisites	
GPA/NGPA	GPA		Lab/Assignments	3		

Learning Outcomes

After completing this module, the students should be able to

- Evaluate available techniques and algorithms for vision based automated environments such as object detection and inspection
- Design new algorithms and customize existing algorithms for automated object detection and measurements using visual data as inputs

Outline Syllabus

- **Introduction to machine vision and its applications**
- **Geometry of image formation**
- **Basic image filtering**
- **Edge and line detection**
- **Image segmentation**
- **Feature extraction**
- **Morphological processing**
- **Representation and description in machine vision**

<table>
<tr><td>Module Code</td><td>CS4432</td><td>Module Title</td><td colspan="4">Network and System Administration</td></tr>
<tr><td>Credits</td><td>3.0</td><td rowspan="2">Hours/Week</td><td>Lectures</td><td>2</td><td rowspan="2">Pre – requisites</td><td rowspan="2">None</td></tr>
<tr><td>GPA/NGPA</td><td>GPA</td><td>Lab/Assignments</td><td>3</td></tr>
<tr><td colspan="7"><u>Learning Outcomes</u>

After completing this module, the students should be able to
• configure networks and systems according to recommended guidelines
• manage users in a system
• manage systems
• manage networks
• manage and maintain services</td></tr>
<tr><td colspan="7"><u>Outline Syllabus</u>

• System configuration and maintenance – recommendations and best practices
• Network management – fault management, configuration, accounting, performance, security
• System management – fault management, configuration, accounting, performance, security
• Storage management – storage, backups, redundancy,
• Services management – licensing, distributed services, multi-tier applications
• Disaster recovery and business continuity management
• Policy frameworks and enforcement – use of networks and systems in a business environment</td></tr>
</table>

<table>
<tr><td>Module Code</td><td>CS4442</td><td>Module Title</td><td colspan="4">Current Trends in Networking</td></tr>
<tr><td>Credits</td><td>3.0</td><td rowspan="2">Hours/Week</td><td>Lectures</td><td>2</td><td rowspan="2">Pre – requisites</td><td rowspan="2">CS3032, CS3412</td></tr>
<tr><td>GPA/NGPA</td><td>GPA</td><td>Lab/Assignments</td><td>3</td></tr>
<tr><td colspan="7"><u>Learning Outcomes</u>

After completing this module, the students should be able to
• describe emerging areas of networking
• critically evaluate the developmental arc of a selected emerging area of networking</td></tr>
<tr><td colspan="7"><u>Outline Syllabus</u>
• Select 3 to 6 areas of current and/or future significance in networking. For each area:
o development of the area
o theory and principles used in the area
o current status of technology
o future trends
• Conduct a comprehensive study on a selected topic in networking and prepare a report.</td></tr>
</table>

<table>
<tr><td>Module Code</td><td>CS4452</td><td>Module Title</td><td colspan="4">Information Security and Cryptography</td></tr>
<tr><td>Credits</td><td>3.0</td><td rowspan="2">Hours/Week</td><td>Lectures</td><td>2</td><td rowspan="2">Pre – requisites</td><td rowspan="2">CS3052</td></tr>
<tr><td>GPA/NGPA</td><td>GPA</td><td>Lab/Assignments</td><td>3</td></tr>
<tr><td colspan="7"><u>Learning Outcomes</u>

After completing this module, the students should be able to
• demonstrate theoretical principles of information security
• apply information security principles in information processing and exchange</td></tr>
<tr><td colspan="7"><u>Outline Syllabus</u>

• Information security models
• Access control theories and techniques
• Cryptography and related concepts, theories, standards, and methods
• Key exchange, digital certificate systems and protocols
• Application security, attacks and counter measures</td></tr>
</table>

Module Code	CS4462	Module Title	Computer and Network Security			
Credits	3.0	Hours/Week	Lectures	2	Pre – requisites	CS3032, CS3052
GPA/NGPA	GPA		Lab/Assignments	3		

Learning Outcomes

After completing this module, the students should be able to

- assess the security of computer systems and networks
- design secure networks and application environments

Outline Syllabus

- **Secure computer systems**
  - OS security principles, exploitations
- **Secure networks**
  - Security devices: Firewalls, IDS, IPS, etc.
  - Secure designs
- **Client and server security**
  - Secure applications
- **Secure Protocols**
  - Kerberos, VPN, L2TP, PPTP, IPSec, SSL, HTTPS
- **Security standards**

Module Code	CS4472	Module Title	Mobile Computing			
Credits	3.0	Hours/Week	Lectures	2	Pre – requisites	CS3022
GPA/NGPA	GPA		Lab/Assignments	3		

Learning Outcomes

After completing this module, the students should be able to

- identify the technologies, devices and applications which enable mobile computing
- discover the issues which need to be considered when developing a mobile application
- design and implement sophisticated mobile applications

Outline Syllabus

- **Mobility in computing systems**
- **Mobility management**
- **Mobile and wireless networking technologies and standards**
- **Data and resource management**
- **Design issues for mobile computing systems**
- **Technologies used to enable mobility in information systems**
- **Design and implementation of mobile applications**
- **Further topics**

Module Code	CS4482	Module Title	High Performance Networking			
Credits	3.0	Hours/Week	Lectures	2	Pre – requisites	CS3032, CS3412
GPA/NGPA	GPA		Lab/Assignments	3		

Learning Outcomes

After completing this module, the students should be able to

- present advance concepts and theories in networking
- present the findings after conducting research in an assigned area in networking

Outline Syllabus

- **Issues and new trends in network protocols**
- **Variants of OSI protocol stacks – emerging protocols**
- **Networking models and concepts, graph theory, mathematical and statistical models**
- **Highly distributed and adaptive networks**
- **New theories on QoS, traffic management, fault tolerance, performance and handling, etc.**

Module Code	CS4492	Module Title	Wireless and Broadband Networking			
Credits	3	Hours/Week	Lectures	2	Pre-requisites	–
GPA/NGPA	GPA		Lab/Assignments	3		

Learning Outcomes

After completing this module, students should be able to:

- Describe wired and wireless broadband technologies, standards, and services
- Select, justify, and apply wireless and broadband technologies to solve some of the real-world problems
- Design, deploy, and manage a wireless network complying to a specific set of constraints

Outline Syllabus

- **Introduction to Wireless Communications**
  - Radio waves and wireless signal encoding techniques, wireless networking issues and constraints, mobile personal communication devices, wireless internetworking devices
- **Wireless Personal Area Networks (WPANs)**
  - Infrared, Bluetooth, ZigBee, and high speed WPANs
- **Wireless Local Area Networks (WLANs)**
  - IEEE 802.11 standards, WLAN planning, configuration and troubleshooting, and WLAN security
- **Wireless Metropolitan Area Networks (WMANs)**
  - Last mile connections to the Internet, fixed and mobile WiMAX, 3G, 4G
- **Wireless Sensor Networks (WSNs)**
  - Sensor network design, WSN applications, routing, data fusion, clustering
- **Fixed Broadband Technologies**
  - xDSL, ATM
- **Services and QoS**
  - VoIP, IP multimedia subsystem, mobile IPTV, mobile social networking, location-based services

Module Code	CS4522	Module Title	Advanced Algorithms			
Credits	3.0	Hours/Week	Lectures	2	Pre – requisites	CS2022
GPA/NGPA	GPA		Lab/Assignments	3		

Learning Outcomes

After completing this module, students should be able to

- modify basic data structures to overcome drawbacks
- apply advanced techniques for analysis of algorithms
- apply advanced techniques for design of algorithms
- design and analyze algorithms in selected/specialized domains

Outline Syllabus

- **Advanced data structures**
  - Red-black trees
  - Binary decision diagrams (BDDs)
  - B-trees
  - Splay trees
- **Advanced design and analysis**
  - Randomized algorithms
  - Amortized analysis
  - Optimization techniques
- **Graph algorithms**
  - Flow networks, max-flow-min-cut theorem
  - All-pairs-shortest-path problem, transitive closure
- **Matrix and numerical algorithms**
- **Other /current topics**

Module Code	CS4532	Module Title	Concurrent Programming			
Credits	3.0	Hours/Week	Lectures	2	Pre – requisites	CS2012, CS2042, CS2062
GPA/NGPA	GPA		Lab/Assignments	3		

Learning Outcomes

After completing this module, students should be able to

- explain the concurrency aspects of a specified system
- evaluate methods of implementing concurrency for a given situation
- evaluate the impact of concurrency implementation on system components
- implement systems with concurrency

Outline Syllabus

- **Theory of concurrency**
  - Shared objects and Mutual exclusion
  - Registers
  - Linearization
  - Consensus
  - Lock free synchronization
  - Wait free synchronization
  - Safety and liveness properties
- **Synchronisation methods**
  - Semaphores
  - Monitors
  - Barriers
  - Spin locks
  - Compare-and Set
- **Parallel programming with multiprocessors**
- **Cache optimization**
- **Concurrent data Structures**
  - Lock-free and wait free stacks and queues

Module Code	CS4542	Module Title	Compiler Design			
Credits	3.0	Hours/Week	Lectures	2	Pre – requisites	CS2022
GPA/NGPA	GPA		Lab/Assignments	3		

Learning Outcomes

After completing this module, students should be able to

- explain the stages of a compiler and how they operate
- apply common techniques and tools used in designing compilers
- analyze compiler implementation techniques and simple optimization techniques

Outline Syllabus

- **Review of lexical, syntax and semantic analysis**
- **Implementation techniques and run-time issues**
- **Intermediate representation**
- **Supporting language features**
- **Code generation and code optimization techniques**
- **Data flow analysis**
- **Control flow analysis**
- **Basic blocks**
- **Liveness analysis**
- **Inter-procedural analysis**
- **Machine dependant optimisation**

Module Code	CS4552	Module Title	Scientific Computing			
Credits	3.0	Hours/Week	Lectures	2	Pre – requisites	
GPA/NGPA	GPA		Lab/Assignments	3		

Learning Outcomes

After following this course, students should be able to

- analyse a computational problem and design an efficient algorithm to solve it
- optimise a scientific program under specified resource constraints
- evaluate computational methods their suitability for use in scientific and engineering problems

Outline Syllabus

- **Introduction to Scientific Computing**
- **Patterns for Parallel Programming**
  - Task decomposition, Data Decomposition, Group task, Order Tasks
  - Task Parallelism, Divide and Conquer, Geometric Decomposition, Pipelining
  - SPMD pattern, Master/Worker pattern, Fork/Join, Loop Parallelism, Shared Data, Shared Queue, Distributed Array
  - Memory Synchronisation and Fences, Barrier Synchronisation, Mutual Exclusion
- **Programming environments for scientific computing**
  - Cluster/Grid computing - MPI
  - Shared Memory Multiprocessors - OpenMP, GPU computing, CUDA programming
- **Algorithmic implementation for numerical methods**
  - Linear and non-linear systems
  - Optimisation
  - Visualisation
  - Ordinary and partial differential equations
- **Case Studies**
  - Computational Finance – Monte Carlo simulations (Geometric Brownian motion, CIR, Jump Diffusion processes)
  - Data mining
  - Bio-medical applications **–** MRI
  - Computational Fluid Dynamics

Module Code	CS4622	Module Title	Machine Learning			
Credits	3.0	Hours/Week	Lectures	2	Pre – requisites	CS3612
GPA/NGPA	GPA		Lab/Assignments	3		

Learning Outcomes

After completing this module, the students should be able to

- describe the fundamental concepts in problem solving with intelligent systems
- explain the mathematical basis for the techniques used in machine learning
- evaluate and select the appropriate computational intelligence techniques for a given problem
- construct a solution for a real world application using the appropriate computational intelligence techniques

Outline Syllabus

- **Problem Solving With Computational Intelligence: The Basic Concepts**
- **Single-Layer and Multi-Layer Feed-forward Neural Networks**
- **Feedback Neural Networks**
- **Associative Memories**
- **Self-Organizing Feature Maps**
- **Support Vector Machines**
- **Genetic Algorithms**
- **Fuzzy Sets and Fuzzy Logic**
- **Fuzzy Neural Networks**
- **Swarm Intelligence and Ant Colony Optimization, Effectiveness and Computational Complexity of Computational Intelligence Models.**

Module Code	CS4632	Module Title	Database Internals			
Credits	3.0	Hours/Week	Lectures	2	Pre – requisites	CS3042
GPA/NGPA	GPA		Lab/Assignments	3		

Learning Outcomes

After completing this module, the students should be able to

- explain the basic ACID properties of a database
- describe the basic fundamental concepts in transaction processing
- apply the knowledge of database internals to improve the performance of database systems
- demonstrate the use of an appropriate database solution for an application that requires complex data storage and manipulation

Outline Syllabus

- **File Organization and Indexes**
- **Query Optimization**
- **Physical Database Design tuning decisions**
- **Transaction Management in Databases**
- **Database Administration**
- **Parallel and Distributed Databases**
- **Active Databases**
- **Temporal Databases**
- **Spatial, Text and Multimedia Databases**
- **Object Databases**
- **Deductive Databases**
- **Current applications and research trends in advanced database topics**

Module Code	CS4642	Module Title	Data Mining and Information Retrieval			
Credits	3.0	Hours/Week	Lectures	2	Pre – requisites	CS3612
GPA/NGPA	GPA		Lab/Assignments	3		

Learning Outcomes

After completing this module, the students should be able to

- describe the basic fundamental concepts involved in the process of discovering useful, possibly unexpected, patterns in large data sets
- explain the various stages involved in the data mining and information retrieval process
- explain the computational challenges and appropriate solutions available in implementing modern data mining and information retrieval systems
- evaluate, choose and implement an appropriate solution for a given data mining or/and information retrieval application from a wide array of application domains

Outline Syllabus

- **Introduction and motivation**
- **Data mining primitives including data representation**
- **Data pre-processing**
- **Data warehousing**
- **Data visualization**
- **Concept descriptions**
- **Association rule mining**
- **Classification**
- **Clustering**
- **Page ranking and searching**
- **Ontology engineering**

Module Code	CS4722	Module Title	Computer Vision			
Credits	2.0	Hours/Week	Lectures	2	Pre – requisites	CS2022
GPA/NGPA	3		Lab/Assignments	3		

Learning Outcomes

After completing this module, students should be able to

- explain the principles of machine vision and how it can be used in practical applications
- judge the importance of machine perception of images
- apply mathematical techniques and related algorithms for image understanding

Outline Syllabus

- **Image formation**
- **Edge detection**
- **Boundary detection and image segmentation**
- **Image features**
- **Mathematical morphology**
- **Shape and boundary descriptors**
- **Elementary pattern recognition**
- **Texture recognition**
- **Marr's paradigm**
- **Active vision**
- **Calibration problems**
- **Correspondence and flow**
- **Stereo and motion**

Module Code	CS4732	Module Title	Computer Graphics			
Credits	3.0	Hours/Week	Lectures	2	Pre – requisites	CS1032
GPA/NGPA	GPA		Lab/Assignments	3		

Learning Outcomes

After completing this module, the students should be able to

- demonstrate the difference among different types of computer graphic representation
- select suitable graphic formats and transforms for different application domains
- create and edit graphic elements and content using different types of tools
- publish graphical media on different rendering platforms

Outline Syllabus

- **Introduction to computer graphics**
- **Types of graphic content; raster Vs vector, linear Vs non-linear graphics**
- **Rendering techniques**
- **2D and 3D graphics**
- **Graphic and media publishing platforms**
- **Projections and transforms**
- **Illumination and shading**
- **Texture creation and mapping**
- **Principles of animation**

Module Code	CS4742	Module Title	Bioinformatics			
Credits	3.0	Hours/Week	Lectures	2	Pre – requisites	CS1032
GPA/NGPA	GPA		Lab/Assignments	3		

Learning Outcomes

After completing this module, students should be able to

- appreciate, understand and develop applications of computer technology to management of biological information
- apply algorithms to facilitate and expedite biological research in analysing and visualising vast amounts of genome data that are being gathered presently

Outline Syllabus

- **Molecular Biology**
  - An introduction to Bioinformatics
  - Molecular biology
- **Biological Sequence Data Analysis**
  - Basic alignment problems
  - Database searches
  - Heuristic alignment algorithms
- **Pattern Discovery and Recognition**
  - Gene finding and Motif discovery
  - Hidden Markov models
  - Sequence profiles
- **Systems biology**
  - Biological networks
  - Network Motif analysis
- **Applications of bioinformatics**

Student Projects

Extensive project work forms an integral part of the degree programme. For example, all students engage in group/individual projects in many courses. The structure of the project group may vary for each course. In addition to project work done as assignments in taught modules, students are required to carry out a group project in their final year. In the final year project, typically, there are four students in a group, with each group assigned a staff supervisor. The final year project groups work on the research, design and implementation of a fairly comprehensive project. The subject matter can be an application of computing, systems software, hardware construction, interfacing of communications or graphics, or almost any related issue. This project represents a significant work-load of the final year and includes a substantial project report or dissertation, a presentation and a viva. Thus, students gain practical experience in research, the specification, design and implementation of a solution, as well as exposure to the essential group skills of collaboration, project planning, documentation, public presentation and critical assessment.

Verbal and written communication skills are also an essential part of professional life and are vital to the success of a project. Considerable importance is therefore attached to the parts of the degree programme dealing with the presentation of technical information in the form of laboratory reports, project reports, presentations and short talks. We are concerned with developing students' abilities to organize themselves for later professional activities and making them aware of the ethics involved. To this end, we teach a final-year core course that addresses professional issues.

Student Feedback

Feedback from students is important to us. The Department thus has regular meetings with the participation of the student representatives, which provide a more formal channel of communication between staff and students. Student representatives from each academic year attend meetings with members of staff to discuss the courses, the quality of our teaching and facilities, and any problems or other matters.

Students give feedback through a standard feedback form for each module at the end of a semester. This feedback mechanism has helped the Department immensely in identifying the students' needs and problems with courses, enabling improvements and changes where necessary. In addition to the formal feedback mechanism, students have very close contacts with their academic coordinators with whom they freely discuss matters regarding academic and personal life. The informal feedback also helps the Department in many ways in identifying the students' needs.

Honour Code

CSE firmly believes in establishing and maintaining highest academic standards by inculcating discipline among students. The Honour Code is intended to enforce integrity in all academic activities students are assigned to, for as long as they remain undergraduates at the Department of Computer Science and Engineering. Although rules and regulations have already been in place with regard to academic offences, CSE was the first department to introduce a written agreement the students must agree to upon commencing studies at the department.

Drafted following the Stanford University Honour Code, CSE Honour Code states that a student:

- Will not give or receive aid in examinations and quizzes;
- Will not give or receive un-permitted aid in class work, in the preparation of reports, or in any other work that is to be used by lecturers as the basis of grading;
- Will do their share and take an active part in seeing to that that others as well as themselves uphold the spirit and the letter of the Honour Code

The Honour Code will be treated as violated if a student

- Copies from another's examination paper or allows another to copy from one's own paper
- Gets involved in un-permitted collaboration
- Produces plagiarized content in any written work
- Revises and/or resubmits a quiz or exam for grading without the instructor's knowledge or consent.
- Represents as one's own work, the work of another.
- Gives and/or receives aid on an academic assignment under circumstances in which a reasonable person should have known that such aid was not permitted.

CSE holds a formal pledge ceremony, in which the incoming students read the honour code statement out loud and sign the pledge before the faculty acknowledging their consent to abide by the honour code.

Annual CSE Events

The department of CSE is fully dedicated to enhance the transferable skills of the students. These skills help the students be poised, confident, mature, and balanced, in many situations, as well as in the profession of engineering. In order to arm the students with leadership qualities, creativity, decision making abilities, team work and the innovative ideas, the department puts a lot of effort to organize fabulous events such as the Mentoring Program, the Programming Competition and the Drama Festival, despite a busy schedule in the academic program.

Mentoring Programme

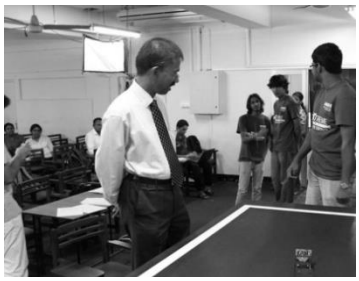
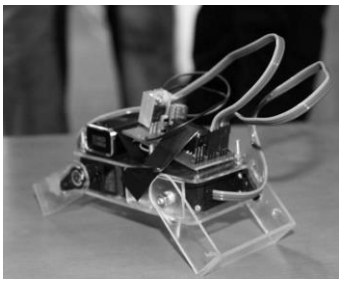
The “CSE Mentoring program” is one of the foremost programs, organized by the department in order to give undergraduates the opportunity to gain industrial exposure, build corporate awareness and develop soft skills. This effort by the CSE staff in collaboration with the industry, targets to build confidence, and to improve the personality and professionalism of the students.

Under this program, the students get the privilege of meeting and communicating with top level drivers of the IT industry in Sri Lanka, who act as mentors of the students.

The program covers important sessions related to leadership, team work and personality development. The activities conducted for personal development include, requiring the students to read a set of books covering various self-improvement topics such as leadership and time management, and to present their findings to the class.

CSE Engineering Design Competition

CSE Engineering Design Competition is a project in which the students, as groups, are required to build an engineering solution to a problem and take part in a competition among groups where they have to complete a given. The project involves design and development of mechanical components and electronic circuitry, and the use of CAD (Computer Aided Design) tools. It also stimulates production and marketing, packaging, team building, presentation and report writing skills. The main objective is to engage the students in enhancing their engineering design skills.

Programming Competition

The Programming Competition is another event organized to improve the technical skills of students in the software engineering domain. The idea behind the programming competition is to make students develop the skills and confidence in engineering a software application so that they can build robust, high performance and creative applications competitively. It is also a remarkable opportunity, for students to take part in a thrilling game and compete with their batch mates. The students develop their own program to play against a game server built in-house at the department and compete with other challenging groups.

The 2013 edition of the Programming Competition was titled 'Tank Game', which as suggested by its name, involved the participants hunting for treasures, hidden in different locations in the island. The players had to play the role of travelers hunting for treasures, while trying to overcome myriad obstacles and pitfalls in the environment and attacks of open enemy tanks.

The Programming Competition encourages students to build up their programming skills. Furthermore, the competitive nature of the event helps them enhance their team spirit and collaborative skills. This is an event organized across two semesters. The students are equipped with the necessary technical competencies in Semester 3 in preparation for the competition taking place in Semester 4.

DramaFest

The Drama Festival (DramaFest) is a spectacular event in the CSE Event Calendar, staged with the objectives of improving the students' expressiveness, crafting their confidence and molding them into versatile all-rounders. It gives a valuable opportunity for the students to learn communication skills, and the stage performances help the students improve their confidence in presentation skills.

The DramaFest is organized annually by semester 5 students under the patronage of their seniors in Semester 7.

CSE Out-boundz

CSE Out-boundz is an event that provides a platform for both the junior and senior students to interact with the staff and get to know each other better. It gives an opportunity to freshen up the minds and take a break from the hectic daily schedules. By organizing this event, the students develop their creativity and team-working abilities. For instance, in a previous event, the students remarkably transformed a university outdoor location into an ancient village with thatched tents, bridges and even tree houses. The event is typically filled with energy and entertainment with a number of interactive games.

This annual event, which has seen through four seasons so far, namely, Out-boundz in 2008, Indifferenz in 2009 Beyond Wavez in2010, Vibez in 2011 and Resurgenze 2012, is hosted by students in Semester 3.

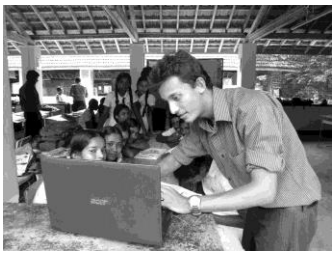
Hit the Grounds

CSE organizes 'Hit the Grounds' Cricket Tournament providing a day of fun and camaraderie for the students, the staff and the industry. The tournament is open to teams formed by students, staff and software industrial firms in Sri Lanka. The number of participating teams has been increasing throughout the past years, and today, 'Hit the Grounds' has become "The Cricket Tournament" for local IT companies.

CSE Community Projects

The CSE students are encouraged to understand their social responsibilities and to come forward enthusiastically in organizing community service projects every year. For example, in 2010, the students of Batch 2009 organized a project to colour wash the Help Kids Foundation Orphanage. In early 2012, students from Batch 2010 organized a seminar series to raise awareness on ICT covering many schools in different parts of Sri Lanka. In 2013, students from Batch 2010 conducted two ICT seminars for grade 12 and 13 A/L students.

First seminar was held in Sumangala Boys College Panadura for all the students who are doing ICT in Kaluthara Districs. Second seminar was held at Princess of Wales College Moratuwa for students in Piliyandala Educational Secretarial zone. The seminar series was well received by their respective audiences for its timely subject matter and attractive presentations. These events help CSE students understand that they should not only be engineers who are armed with technical expertise, but that they also should help the country and the world through social service.



CSE Symposium

The CSE Symposium was held for the first time in 2010 and is now an important event in our event calendar. This event, organized and conducted by the students in their fourth year of study, is intended to present the software engineering project work of students to their peers and the IT industry. All submissions are reviewed and accepted papers are published in the symposium proceedings. The objective of the symposium is to introduce students to research methodologies, development processes and professional technical writing at an early stage in their engineering practice.

Competitions

The students in the Department of CSE are strongly encouraged and supported to participate in local and international competitions. Participation in these events broadens the knowledge base of students and sharpens their skills.

Google Summer of Code (GSoC)

GSoC is a global program that offers student developers stipends to write code for various open source software projects. Since its inception in 2005, the students in the Department of CSE have participated in the GSoC program in significant numbers. Through the GSoC program, accepted student applicants are paired with a mentor or mentors from the participating projects. Thus the students gain exposure to real-world software development scenarios and gain opportunities for employment in areas related to their academic pursuits. In turn, the participating open source projects are able to more easily identify and bring in new developers. Best of all, more source code is created and released for the use and benefit of all. See **http://code.google.com/soc/** for more information.

ACM International Collegiate Programming Contest (ACM ICPC)

ACM ICPC is a multitier, team-based, programming competition operating under the auspices of ACM and headquartered at Baylor University. The contest involves a global network of universities hosting regional competitions that advance teams to the ACM-ICPC World Finals. Thousands of students and faculty from the world's leading Universities participate in this event. The contest fosters creativity, teamwork, and innovation in building new software programs, and enables students to test their ability to perform under pressure. Quite simply, it is the oldest, largest, and most prestigious programming contest in the world. See **http://cm.baylor.edu/welcome.icpc** for more information.

IEEE Xtreme Programming Competition (IEEEXtreme)

IEEEXtreme is a global challenge for teams of student members, supported by an IEEE Student Branch or university. Participating in IEEEXtreme gives students a unique and fun learning experience, while competing with teams of students from around the world in a global event.

BCS NBQSA

NBQSA competition is an annual event organized by the British Computer Society Sri Lanka (BCSSL) Section. The avowed objectives of the NBQSA competition are threefold: To provide recognition to outstanding achievements of individuals and organizations in Sri Lanka who/which have contributed to the development of ICT, to create a window to gain international recognition for

locally developed ICT products and to improve standards and the quality of local ICT products and services to be able to compete in the international market place. The award category applicable to CSE students is the “Tertiary Student Project”. This award is presented to the most innovative ICT software and/or hardware project from students of Institutions of Higher Learning. See **http://www.nbqsasrilanka.org/** for more information.

IESL RoboGames

“IESL RoboGames 2013” is a challenging robotics contest where innovative Sri Lankan undergraduates and school students compete to lead the autonomous robots built by them towards the victory while sharpening their skills. This competition is a result of the collaboration between The Institution of Engineers, Sri Lanka and Department of Computer Science and Engineering of University of Moratuwa. IESL RoboGames is held in conjunction with the annual exhibition “IESL Techno”.

Innovation CSE

Held for students newly accepted into the Department at the end of Semester 1, this competition involves the new entrants being split up into groups to design and build a product according to a given set of specifications within a set period of time. The products are then evaluated by the staff, with prizes awarded for a number of different aspects of the competition.

CSE Programming Competition

Open only to Level 2 students, this competition involves students designing an interactive game client to hunt for treasures generated by a ‘game sever’ that is run by the department.

Other Useful Information

Getting Help and Advice

Students are always encouraged to discuss any issues or problems they have with their Semester Coordinators. Additionally, they can seek assistance from subject lecturers or the Head of the Department.

Semester Coordinators

Semester	Coordinator
S1	Prof Sanath Jayasena
S2 & S3	Dr. Chandana Gamage Ms. Vishaka Nanayakkara Dr. Surangika Ranatunga Dr. Shehan Perera (Mentoring)
S4 & S5	Dr. Rapti de Silva Dr. Dulani Meedeniya
S6 & Training	Dr. Dilum Bandara (Training) Dr. Malaka Walpola (CSE) Ms. Sulochana Sooriyarachchi (ICE)
S7 & S8	Dr. Indika Perera Dr. Chandana Gamage Dr. Charith Chitraranjan (FY Project)

Frequently Asked Questions

Q.1	How do I register for subjects?
A.1	Contact Director/Undergraduate Studies at the undergraduate studies division in the Sumanadasa building, 1st Floor. (Ext.3050)
Q.2	Whom should I contact for bursary/scholarship?
A.2	Contact Assistant Registrar in the student welfare division in the welfare office. (Ext. 1831)
Q.3	Whom should I inform if I fall ill?
A.3	If you are in campus, visit the university medical centre. Otherwise inform your semester coordinator by Phone/SMS/E-mail. Obtain a medical certificate from a SLMC registered medical doctor and keep all your medical records, prescriptions, etc for further reference. (Ext. 1810).
Q.4	Whom should I inform if I miss a practical, quiz or any other continuous assessment?
A.4	Inform the Lecturer-in-Charge of the subject.
Q.5	Whom should I inform if I miss an examination?
A.5	Inform the SAR/Examinations in the Examination Branch within 48 hours. Also inform your semester coordinator immediately by phone/SMS/E-mail. Keep all records related to your absence for the exam safely for future reference. (Ext.1401)
Q.6	Whom should I contact for security related issue?
A.6	Chief security officer in the security office (Ext.1901)

Industry Alliances

Department Industry Consultative Board (DICB)

The Department Industry Consultative Board of the department consists of many senior executives from the local IT industry, the staff of the department, and two student representatives. The Department organizes regular meetings to obtain views and suggestions from the industry to improve the degree programme. The IT industry constantly contributes to this effort with valuable suggestions and support with funding, expertise and other resources.

Direct Coordination of the Industrial Training Programme

The Department of CSE directly coordinates and supervises the finding of industrial placements for the students and assists the Industrial Training Division of the Faculty of Engineering in monitoring and evaluation of the trainees. With strong industry collaborations, this scheme has been highly successful and the students have been able to obtain training at a place relevant to their technology and career interests.

Lanka Software Foundation (LSF)

The Lanka Software Foundation (LSF) is a non-profit foundation whose mission is to encourage Sri Lankan developers to participate in global open-source software projects. LSF believes that open-source can be a major positive influence in the further development of Sri Lanka, including in the following roles.

It presents an opportunity for Sri Lanka's IT industry to become a driving force in the global computing industry.

On a different level, the usage of open-source software in societal and educational applications can greatly reduce the cost of large-scale deployments of software.

Similarly, open-source has a significant role to play in e-government issues. The Department of Computer Science and Engineering houses one of the three development labs that LSF operates. This lab has facilities to accommodate several software developers.

Graduate Studies at CSE

By offering post graduate courses, the CSE Department intends to fulfill the demand of educated employees in the IT industry for a high quality post graduate qualification.

In the late 1990's, the Department of Computer Science & Engineering embarked in offering a Master of Science degree (M.Sc.) in Research to fulfill the higher training required for the development of the IT industry in the country.

Another postgraduate program offered by the Department is the MBA (Master in Business Administration) in IT degree program. It is intended to train IT managers for the modern business environment. The MBA program offers subjects that provide a core knowledge-base in the fundamentals of business management and the key areas of IT.

The MBA in e-Governance is aimed at preparing participants for successful planning and implementation of e-governance initiatives and would enable the participants to build collaborative networks with software engineers and IT professionals.

The Master of Science (MSc) / Postgraduate Diploma (PG Dip) in Computer Science is another postgraduate program offered by the Department. It was launched with the objective of arming the IT professionals such as practicing engineers, software developers and other computer professionals with the necessary knowledge to make them better equipped to handle the ever changing world of technology.

The Alumni Association

The Computer Science & Engineering Society (CS&ES) is an association of Computer Science & Engineering graduates, undergraduates and staff dedicated to developing and uplifting the Department of CSE and to broaden its engagement with the industry and society.

The emerging shape of the 21st century demands all of us to be on par with the growing trends in the field of Information Communication Technology. Since its inauguration in 1997, driven by the dedicated effort of its members, the CS&ES has made significant contributions to the CSE as well as the industry.

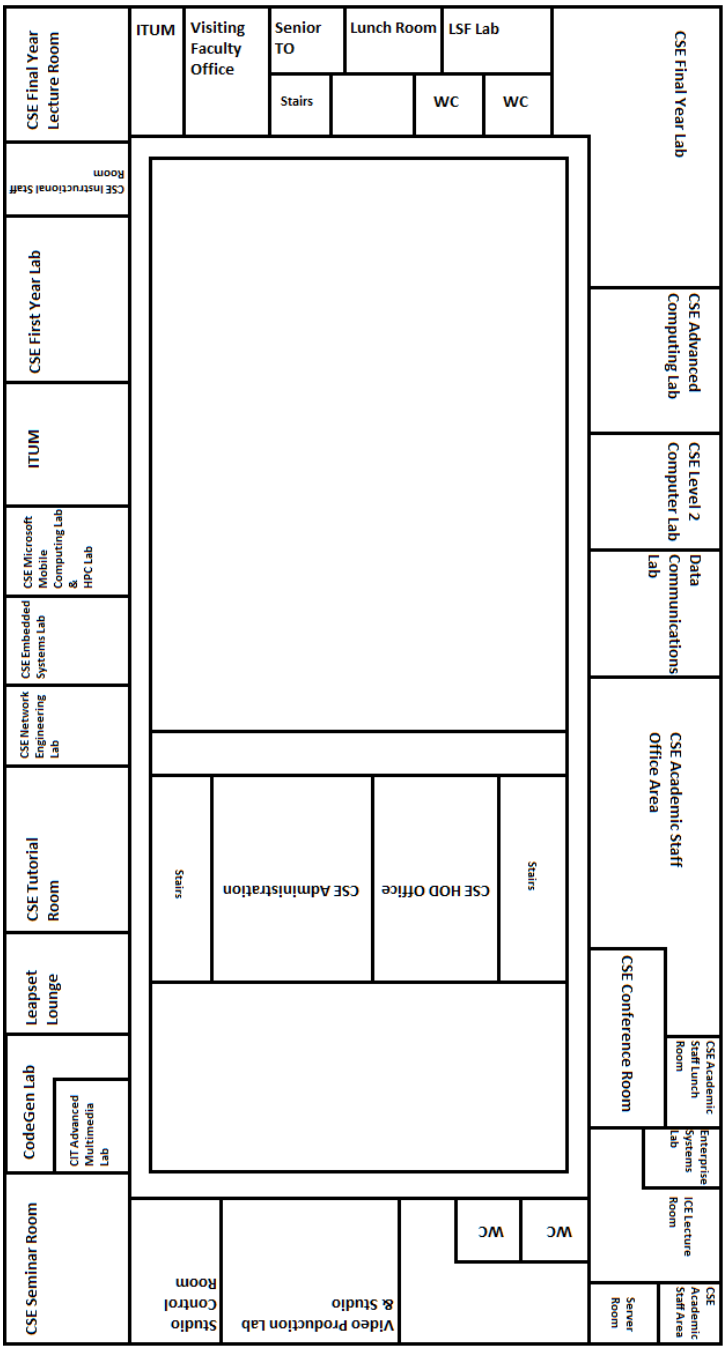
The CS&ES aims to fulfill its vision and mission through workshops, seminars, conferences, competitions, etc. held for school children, undergraduates, selected categories of professionals, and the general public.

The CS&ES engages in the following activities, both at national and international level, in order to work for the accomplishment of the objectives of the CS&ES:

- To obtain modern computing and laboratory equipment to the CSE.
- To organize lectures, seminars, workshops to its membership and to the general public with the objective of introducing them to leading edge technologies.
- To introduce the CSE undergraduates to emerging technologies by helping them to find suitable organizations for their industrial training and industry sponsors and supervisors for the final year projects.
- To create awareness among the CSE undergraduates on the available jobs in the industry and industry expectations in hard engineering competencies and soft skills.
- To bring together graduates and undergraduates of the CSE to share their experiences and provide mentoring for career development and professionalism.
- To assist the CSE to obtain services of internationally recognized academics, researchers, technologists, and institutions in the field of Computer Science and Engineering in the development and conduct of the CSE degree program.
- To celebrate the achievements of the alumni and partner organizations to inspire and motivate.

Location and Layout of the Department

The Department of CSE lecture rooms, laboratories, office rooms and other facilities are located in the 2nd floor of the Sumanadasa Building.


CSE Final Year Lecture Room
ITUM
Visiting Faculty Office
Senior TO
Lunch Room
LSF Lab
Stairs
WC
WC
CSE Final Year Lab
CSE Instructional Staff Room
CSE First Year Lab
CSE Advanced Computing Lab
ITUM
CSE Level 2 Computer Lab
CSE Microsoft Mobile Computing Lab & HPC Lab
Data Communications Lab
CSE Embedded Systems Lab
CSE Network Engineering Lab
CSE Academic Staff Office Area
CSE Tutorial Room
Stairs
CSE Administration
CSE HOD Office
Stairs
Leapset Lounge
CSE Conference Room
CSE Academic Staff Lunch Room
CodeGen Lab
CIT Advanced Multimedia Lab
Enterprise Systems Lab
ICE Lecture Room
CSE Seminar Room
Studio Control Room
Video Production Lab & Studio
WC
WC
Server Room
CSE Academic Staff Area

Back Cover